Music and Language: The Case for Music in Linguistic Curricula and Research

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Abstract

This dissertation offers an interdisciplinary argument in favour of integrating empirically grounded musicological evidence into linguistic curricula. Phonological, syntactic, and neurological convergences between music and language are identified and supported by existing research. However, differences in semantic content and the deliberateness ascribed to a musical or linguistic event inhibit the extent to which a music-language comparison can advance without qualification. In order to create a forum appropriate for the breadth of this discussion, two experiments were conducted. The first experiment presents a unique music-linguistic phenomenon, suggesting that the major and minor modes in music are non-arbitrarily associated with certain linguistic stimuli (*kiki* and *bouba*, respectively) in accord with their phonetic characteristics (e.g. vowel and consonant quality). This topic is considered in the light of evidence from synaesthesia and sound symbolism. Having endeavoured to show the relevance of a joint discussion on music and language, the second experiment explores the level of accord within the linguistic and musical academic communities (university students and teachers/researchers) on salient themes relative to such a discussion. A questionnaire form was administered, with results indicating that an insufficient amount of interdisciplinary agreement exists to facilitate a productive exchange and evaluation of ideas. Interdisciplinary topics and epistemological implications are discussed.

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And to those many other individuals, too numerous to mention, who helped along the way, I give you my best and hope that the music is passionate and the language is comprehensible wherever you are.

Declaration

I declare that this thesis was composed by myself, that the work contained herein is my own except where explicitly stated otherwise in the text. This work has not been submitted for any other degree or professional qualification except as specified.

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Chapter 1

Introduction

Music and language are not the same. However, the remainder of this dissertation will endeavour to show that they are sufficiently similar to warrant serious consideration by linguists and musicians alike. When teaching students in the university classroom or formulating theories to conduct novel research, knowledge of music-language similarities and differences can only be an academic asset. In addition to providing a broad literature review, I have conducted two experiments to support an argument in favour of music integration into linguistic curricula[1]. The first experiment challenges the arbitrariness by which we associate two unrelated novel auditory stimuli. Aside from revealing an interesting linguistic phenomenon, the results attempt to support evidence for an innate synaesthetic disposition in the human mind and raise questions on how we perceive the modality of a musical melody (major or minor) within a semantic context. The second experiment probes the opinions of university teachers and students of both music and linguistics by measuring their awareness of and attitudes towards music-language connections. How differently or similarly two distinct fields respond to the same mutually relevant questions may be a good indication of which clarifications (of any misconceptions) and reconciliations (of any conflicting or impoverished data) are necessary before a productive dialogue can proceed. Interdisciplinary and epistemological considerations are addressed.

These topics of research are interesting for the linguistic field for different reasons. Naturally, if musical evidence offers a more complete understanding of language questions, then such evidence would warrant more consideration than, from my

[1] Language in a musicology programme would be equally beneficial, though for practical reasons, my focus will remain predominantly linguistic

observations, it tends to receive[2]. In the case of semantics however, there is a clear disjoint between what music and language each express communicatively, making it highly problematic to equate with traditional linguistic understandings of meaning without serious qualification. Rather than be deterred by this distinction, the lack of concrete reference combined with the overt deliberateness that is imbued into every musical event (e.g. the art of composition and performance) could be thought of as a source from which the comparison between music and language diverge. This innovative difference presents a good opportunity for meta-analysis of those data that provide mutually relevant and sufficiently interdisciplinary information, such as robust phonological, syntactic and neurological music-language data. In that regard, the questionnaire employed in my research is part sociology, part epistemology, and part ideology. It strives to represent the role of music in the field of linguistics, and inversely, for language within the field of music. In an effort to determine how well, and to what extent, noteworthy music-language findings have been integrated thus far, I will be in a position to consider how such academic confluences may be integrated[3] in the future.

The parts of this dissertation are entitled after the divisions of sonata form, the form traditionally used in the first movement of a symphony. This was done in an effort to remind the reader of the structure and complexity that permeates musical art forms. The Exposition will advance a review of the salient points within sound, structure, and neural architecture that form the crux of the music-language comparison. Having established a firm foundation, the first experiment will be presented in the Development. I will endeavour to explain its results in terms of synaesthesia and sound symbolism, whilst tackling the problems of attributing semantics, in the linguistic sense, to music. The Recapitulation will exhibit the the questionnaire experiment, as well as some thoughts upon the possible interdisciplinary implications before drawing some general conclusions in the Coda.

[2] I will offer a note about my educational background before proceeding forward with the substantive case. I have a Bachelor's of Music and a Master's of Linguistics, as well as extensive language training in Spanish, German, and French. My observation that music and language bear a more than superficial relationship is a result of this education. Subsequently, it has also been my observation that musicians and linguists tend not to agree with me on this point, if what is taught in the classroom or addressed in the assigned readings are an accurate reflection of what is considered relevant discussion in a given field. Both experiments that I conducted were born from this observation and unfolded over the course of the past six years from much personal deliberation on this issue.

[3] By integration I am mainly referring to the material discussed in the classroom, the published literature, and the overall mindset of the academic.

Chapter 2

Exposition: Music and Language

Even before considering the evidence, I find it reasonable to believe that any exposure to highly structured sound patterns (such as music) will be, to some extent, dependent upon the way in which we process language (and vice versa). Whether children come into this world ready to attend to human speech or not is a complicated question. Nevertheless, general auditory processes must also be measured due to the simple truth that all sound enters the brain through the same channel, the ear. At some point, the pathways of music and speech may diverge. Finding out definitively where, how, and why this occurs is of chief importance.

2.1 Pre and Post Natal

That which is present at birth provides evidence for an innate ability. Whether in regard to musicality or linguistic skills, there will be an evolutionary and developmental chronicle that is supported by cross-cultural evidence, research on prelinguistic children (pre and post natal), and meta-analysis from primate audition. The question here is whether this evidence is mutually exclusive or can be applied across two disciplines, thus being used to support or challenge existing theories.

On one hand, children are sensitive to the ambient speech pattern before (DeCasper & Fifer 1980, DeCasper 1994) and immediately after (DeCasper & Spence 1986) they are born, as evidenced by their measured response to a passage read by their mother during her pregnancy. On the other hand, prenatal children are also sensitive to non-speech stimuli to which they are entrained, such as musical excerpts of Mozart or Beethoven (see Karmiloff & Karmiloff-Smith 2001, ch. 1). The prenatal auditory experience, monitoring the sounds that filter through the amniotic fluid, begins as early as twenty weeks into gestation and from six months the foetus can start to familiarise itself and become sensitive to the prosodic features of the mother's voice. As a result, the child can recognise the mother's voice after birth, though it will still prefer her voice filtered through amniotic fluid (Karmiloff & Karmiloff-Smith 2001). Foetal learning also encompasses the rhythmic patterns of the mother's native language, allowing newborn infants to use this experience to differentiate between other languages and their own (Mehler 1988). The child is also aware of other non-speech related auditory stimuli in the womb, such as the mother's heartbeat and breathing rate, as well as the flow of food it receives through the umbilical cord. There is often maternal singing as well (see McMullen & Saffran 2004). Rhythmic features that are reducible to an isochronous palpitation dominate all of these interactions, possibly influencing both language and musical readiness.

Interactions between different inputs from the pre-natal environment suggest a minimal predispositions in place prior to and after birth, allowing children to pay attention to specific aspects of the environment. The ability for infants to attend to and process human speech is often considered to be one of these endowments. Even hearing children born to a congenitally deaf (or mute) mother, who receive essentially no prosodic input from their mother's voice, will manage to learn the ambient language. Musical comprehension may stem from early linguistic and environmental input. Young listeners are sensitive to the structure of pitch intervals relative to the practices of their culture (Dowling 1978), creating a sensitivity to and appreciation for melodic contour that emerges early in infancy (Trehub et al. 1984) and is likely a result of the intonation in speech perception of the ambient language (Patel et al. 1998). There may be a reliable link between the acquisition of speech and the acquisition of our ability to appreciate music (more on this in Section 2.3). As a cautionary measure however, the quality and quantity of the input is a crucial difference to consider when drawing comparisons between language and music acquisition[1]. One should not expect a child to develop more than musical appreciation (or possibly the ability to sing) without actively engaging with an instrument, an activity which, due to practical constraints, they will most likely enjoy once a well-developed linguistic system is already established. The differentiation between active interaction (e.g.

[1] One does not normally even use the term 'music acquisition'.

playing an instrument) and active appreciation (e.g. engaged listening) is a question of exposure and is an important distinction to consider.

2.2 Phonology

Should we assume that the child's phonological system, given the contrasts resulting from an impoverished initial state, is not fundamentally different to the adult system? A universalist theory for acquisition of segmental phonology has been in the linguistic forum for over 60 years (Jakobson 1941/68), although critics have stated that there is much inter and intra-child variation as a result of a tendency to suppress 'natural rules' of language learning (Stampe 1973) or to unlearn/simplify them (Smith 1973). Denying the idea that the child's and adult's phonological systems are quantifiably different may be unappealing because if "this assumption is made, the study of acquisition is not particularly interesting or enlightening for linguists" (Fikkert 2000, p. 1265). Keeping in mind the potential for developmental differentiations, how does linguistic phonology relate to musical sounds? Saffran (1999) and her collaborators have found that adults and infants can segment strings of tones just as well as strings of syllables, which would both confirm a phonological similarity between the developed and impoverished systems and challenge the idea of speech specialisation. Tervaniemi (2003) concludes from an adult study that there is essentially no difference in the perception of linguistic phonemes and musical chords from the data. The auditory cortex is able to represent not only the acoustical but also the informational (phonetic v musical) sound content.

From a decidedly more linguistic perspective, Liberman & Mattingly (1989, p. 489) claim that speech and sound are indeed phenomenologically different and that "the processes that underlie perception of consonants and vowels are specifically phonetic, distinct from those that localise sources and assign auditory qualities to the sound from each source". Thus phonetic comprehension entails a precognitive module[2] rather than a general capacity for cognitive computation. Conversely, both brain lesion studies and functional imaging results show converging evidence for the presence of neural substrates for processing that is hierarchical in organisation for *all* sound sequences (Griffiths 2003). When unpacking the substantive points of these arguments, it is important to remember that tones have been assigned

[2]They also imply that the same might be true of syntax (see Fodor 1983).

absolute values, whereas speech is relative. Though music is often perceived via more relative channels (for example with relative pitch abilities or awareness of transposition and variation technique), it is normally constrained by a fixed system of equal-temperament. Thus, instruments can be out of tune while human speech cannot. From a subjective and more aesthetic perspective however, some languages are deemed as 'easier on the ear' than others and the quality of someone's voice can be a very enchanting (or disturbing) element of their character.

Infants, for example, prefer infant-directed speech (*Motherese*) to adult-directed speech (Fernald 1985) and these prosodic adjustments may provide overt structural cues, making the speech easier to segment and comprehend (see Pinker 1994). There are overt and explicit correlates with common musical expressions. *Motherese* is characterized cross-linguistically by a slower rate of speech, higher fundamental frequency, greater range of pitch variation, longer pauses, and repetitive intonation contours (Fernald 1992). Familiarity with the prosodic patterns of the ambient language (i.e., intonation, stress, etc.) can be demonstrated as early as four months (Kelmer Nelson 1989). There are reports that indicate that infants are even more interested in maternal singing than maternal speech. It would seem that the musical qualities in speech are what motivate its appeal to prelinguistic infants (Trehub & Nakata 2001), and its appeal is recognised very early on. Nevertheless, whether these simplifications beneficially correspond with the child's language growth remains to be definitively answered (Newport et al. 1977, Hoff-Ginsberg 1985). Even though caregivers around the world sing to their infants, and young infants are favourably responsive to such music (Trehub & Trainor 1998), anthropologists have noted that the caregivers within some cultures in Guatemala (Pye 1992), Papua New Guinea (Schieffelin 1992), and Samoa (Ochs 1982) do not even condone speaking with infants directly at all until they come of a certain age. Though potentially counter-evidence to the necessity of child-directed speech for language acquisition, this says nothing in regard to the preference that such speech clearly elicits in the child, a benefit that most parents would consider to be advantageous to their child's well-being.

2.3 Universals

Of all the conceived organisations and intuitions one could attribute to music, why does the listener 'choose' the one he does? The innateness of a musical cognitive capacity is contingent upon evident universals, a musical universal (of a musical grammar) being defined by Lerdahl & Jackendoff 1983, p. 278 as “the principles available to all experienced listeners for organizing the musical surfaces they hear, no matter what idiom they are experienced in.” If musical intuition is not learnt but rather inherent in the mind’s organisation and determined by our genetic inheritance, then cognitive similarities amongst all people and across all cultures, both historically and presently, should be identifiable. Furthermore, these claims will be empirical and thus subject to authentication and falsification by a wide variety of research methods[3].

So if all normally functioning children will fluently acquire the ambient language of a community in roughly three years, what can be said about the majority of people who are essentially ‘not musical’? Moreover, would the idea of ‘not being musical’ sound strange to the ears of tribal communities, cultures where music is inherently twinned with action, dance, and community (see Kubik 1969)? The quality and nature of the input one receives is a factor when considering these questions. For this reason, an ability to *appreciate* music is sometimes discussed in tandem with language acquisition. A universal appreciation system that sets and constrains the parameters of the music faculty, relative to a culture, is allegedly available and functional very early in human development, possibly being “so important to humans that their brain has dedicated some neural space to its processing” (Peretz 2003, p. 201).

Similar lines of reasoning have lead several scholars to draw musical comparisons with Chomskyan Universal Grammar, for instance, Leonard Bernstein’s ‘Unanswered Question’ lectures (1976)[4] or the generative grammar of Swedish folk songs set out by Sundberg & Lindblom (1976). Even the central beliefs of the Suzuki method, a highly influential musical pedagogy technique, state that because “children learn their native language in a natural fashion–properly taught, they can learn music the same way”[5] (Nickels, 1968 p.5 cited in McDonald (1970)). Most notably, the music theorist Heinrich Schenker (1935) proposed a form of analysis that resonates, with some qualification, with the Deep Structure[6] theories propounded in Chomsky (1965).

[3]The cognitive neuroscience of music is particularly insightful here, and will be discussed in greater detail in Section 2.7

[4]Bernstein essentially applied UG wholesale to music, though was generally criticised for doing so (see Lerdahl & Jackendoff 1983, ch.11-12)

[5]Children should learn by ear at the beginning for example, in analogue with the idea the children learn to speak before they can read.

[6]The Minimalist Program (Chomsky 1995) has somewhat abandoned the notion of Deep and Surface Structure for Logical and Phonetic Form.

Schenkerian analysis posits that all formal music has the same type of structure once it is reduced to its fundamental, or *Ursatz*. This reduction is said to reveal something about the nature of music. Humans have a unique ability to recognise the underlying representations of music and formulate abstractions from them. For example, pitches tend to change their direction immediately after the leap of a large interval, the recognition of which Schellenberg (1996) has shown cross-culturally to be a feature of music that manipulates the listener's sense of expectancy. Expectancy, and the prolongation or resolution of the mounting tension, is one way meaning can be derived from music. However, before expounding upon this ebb and flow of semantics in music (see Section 3.3 and how it differs from language semantics, it is necessary to first discuss the hierarchical organisation and structure that underpins our interactions with music.

2.4 Recursion and Structure

Language is infinite, though generated by finite measures. The recursive capability of language has been defined as the only uniquely human characteristic of the linguistic endowment (Hauser et al. 2002; Pinker & Jackendoff see 2005 for a rebuttal), though recent experimental work with European starlings[7] has challenged this position (Genter 2006, Marcus 2006). Recursion is also a property of music. Musical pieces can be lengthened and shortened *ad infinitum* by insertion or deletion of melodic phrases just as a sentence can be with prepositional phrases or relative clauses. Additionally, musical pieces can be transformed both melodically and harmonically, in the case of accompaniment or multiple voices sounding together, though I use the word 'transform' with some reservation. Transformation in the linguistic sense denotes one syntactic construction converting into another semantically related construction. Such changes are comparable in music, though with some qualification. Music is normally regarded as retaining the 'sense' of its former state when it undergoes a transformation. Variation technique or thematic and motivic development does modify the previous state of the material into a different but sufficiently recognisable form. However, the evident transformation is problematic to quantify in the same manner as one may with a linguistic transformation (changing from active to passive

[7]It is worth noting that starlings (and probably all songbirds) have also been shown to be in possession of absolute pitch as well as both transposition and discrimination skills for novel melodies (Hulse et al. 1984).

voicing, for example). The admissible musical relations and permissible transformations are not as concretely constrained, something that is probably a result of the vague, non-referential meaning that we ascribe to musical events.

There are multiple levels of representation within musical structure, yet the listening and performing experience of music demands that we collectively perceive and process them with great rapidity. There is rhythmic and pitch organisation, which are necessarily inter-related (unless there is no overt pitch as is the case with some percussion). And in accord with rhythmic features built into the phylogeny and ontogeny of human existence, it is possible that pitch awareness could have arisen and become integrated with rhythm through self-organising principles “as a random sampling of the universal phonetic space in the presence of performance constraints” (Lindblom et al. 1984). The rhythmic pitch segments, which unfold across a time-span with respect to neighbouring pitches and rhythms, are characterised by certain features such as volume, articulation and timbre. Their differentiation and combinatorial patterns allow for an infinite possibility of musical combinations to emerge from a finite set of elements. As these segments grow in size and complexity, they are processed motivically and thematically, giving way to an understanding of melody, which gives way to development, repetition and variation of that melody, which in turn gives way to many types of structural form and stylistic gestures making up the myriad of musical genres across the globe. Recursion in music is a grouping mechanism across all these levels of representation (Lerdahl & Jackendoff 1983, Sloboda 1998, Trehub 2003). Due to lack of concrete referencing capabilities, I find it more prudent to consider this process as one of expansion rather than the embedding of elaborate semantic meaning.

2.5 Absolute Pitch

In many of the world’s languages, speakers can change the meaning of a word (or verb tense in the case of some West African languages) simply by altering the pitch level at which it is spoken (Crystal 1997). I believe that absolute pitch, the ability to effortlessly and accurately categorise pitch without a reference point, is a fascinating and exemplary system for addressing the complex cognitive functions that are involved in processing such language systems. It allows researchers to see how this specialised ability with no apparent utility[8], which is widely distributed within the population and neatly encapsulated in its neural expression (Zatorre 2003), is germane to other brain functions. It seems to be an atypical organisation of sensory representations that arises through the interaction of genetic factors with environmental input during early development. As a result, brain anatomy[9] may differ between those people with and without absolute pitch, and the language faculty may have an important bearing on this manifestation.

Deutsch et al. (2004) have found that native speakers of tone languages (in this case Mandarin and Vietnamese) are remarkably good at absolute tonal stability and consistency when enunciating pitch for a given word. English speakers of the same task showed significantly less stability. She posits that absolute pitch could be a feature of human speech used to phonetically discriminate an utterance, as one might discriminate a minimal pair by voice quality or voice onset time. She concludes that "the potential to acquire absolute pitch is universally present at birth, and that it can be realized by enabling the infant to associate pitches with verbal labels during the critical period for speech acquisition" (p339; see also Saffran & Griepentrog 2001 for similar conclusions or Peretz & Morais 1989 for the idea of a special 'tonal encoding device'). Absolute pitch has been shown to be over represented in persons of Asian descent (Gregersen 1999) even though not all of these Asians were speakers of tone languages. What is more interesting is that absolute pitch is also over-represented amongst people with autism, that is, people who are not otherwise influenced by a fully developed linguistic system (Saffran & Griepentrog 2001). In the light of such mounting evidence, it seems evident that a discussion of absolute pitch is a relevant consideration in several areas of first language acquisition.

Though nothing like absolute pitch is known to exist in primates (Hauser & McDermott 2003), there is evidence to suggest that they do have some musical processing abilities. Like human speech perception with a certain language, knowledge of music necessarily reflects the experience of listening to a specific style of music. As Pinker & Jackendoff (2005) argue for language, if similarities between humans and animals trained on contrasting musical stimuli are taken as evidence that primate audition

[8] If we consider the proposal from Mithen (2005) that Neanderthals sang instead of spoke and were ultimately driven to extinction by the intellectual superiority of *Homo Sapiens* once they developed language, one may see such pitch perception as an evolutionary hindrance.

[9] A significant difference in the degree of lateral asymmetry in known auditory processing areas in the superior temporal cortex has already been shown (Zatorre 1998).

is a sufficient basis for human music perception, findings of differences following such training must be taken as weakening such a conclusion. Studies with rhesus monkeys (Wright 2000) and macaques (Fishman 2001) indicate that tonal melodies and musical consonance may hold a unique status in primates as well. As these animals do not normally produce or experience music themselves, such results may be more attributable to general auditory processing capabilities rather than a musical adaptation. Thus, in accord with Hauser et al. (2002), the catalyst that separates primitive perception of musical stimuli from music proper of modern man may be in some way inherently related to the recursive abilities of the language faculty.

Due consideration of absolute pitch also has additional points of interest in the linguistic curriculum. Because possessors of absolute pitch retrieve labels from fixed pitch categories, a discussion of *categorical perception* would be quite appropriate. Furthermore, since there seems to be nothing explicit about the way in which absolute pitch is categorised, when mere exposure to pitch and their culturally assigned labels can be sufficient for acquisition (Zatorre 2003), thoughts on *implicit learning* may also be relevant. There may also be comparative topics for debate in regard to the *critical period*. Essentially all the well-documented cases of individuals with full-fledged absolute pitch abilities showed that the possessor had received early musical training, notably before 9-12 years of age (Takeuchi & Hulse 1993). However, musical training alone cannot be the catalyst for development of absolute pitch due to the simple fact that most people do not acquire it, despite being exposed to music at a young age[10]. This could be an indication that absolute pitch discrimination is an artificial, training-based state rather than an innate disposition.

2.6 Consonance and Dissonance

From birth and without necessarily any previous exposure to music of the ambient culture, infants seem to prefer the conventions of tonality to more discordant forms of tonal organisation. Such a musical idiom will establish a tonal centre first, and then manipulate the stability of subsequent pitches in relation to the distance from and harmony with that centre. Atonal music is essentially the opposite, though the process to avoid tonality seems to be an extremely deliberate act. To me, this under-

[10]Still, people without explicit musical training are notably good at singing the pitch of a favourite song (Levitin 1994).

scores much of the natural inclination towards tonality and gives some indication as to why such music that lacks a tonal centre is often quite inaccessible to listeners unfamiliar with such music. Children have greater precision in perceiving diatonic melodies than non-diatonic scales, for example, the major and minor modes as opposed to octatonic scales or twelve-tone rows (Trehub et al. 1990)[11]. They also have superior perception of musical intervals that have smaller mathematical ratios with each other; perfect fifths (3:2) and perfect fourths (4:3) as opposed to tritones (45:32) (Trainor & Heinmiller 1998). The implication here is that the rudiments of our musical listening capabilities are innate, appearing early on in development without any relevant experience. Our 'preferences' are not entirely cultural products. Instead, infants come into this world exhibiting enhanced discrimination of consonant intervals to dissonant ones (Schellenberg 1996), perceptually equipped to converge on the conventions of the ambient music of the culture (see Trehub (2003) for a review).

Consonance and tonal appreciation might come hardwired. A self-evident example is the innate capacity to identify the 'sour note' emanating from an out-of-tune instrument, which is endowed upon listeners regardless of their prior musical training (Cross 2003). An insufficient acquisition of absolute pitch could explain this ability, as it is a cognitive function that can emerge from genetic factors interacting with environmental input during development or atypical organisation of sensory representations (Zatorre 2003). It is interesting to note that pitch recognition abilities exceed the magic number theory of 7 or so categories Miller (1956) because there are 12 discrete musical pitches in the well-tempered Western music system, or considerably more if you consider micro-tones (such as with Indian music). The octave, however, is frequently divided into 5-7 tone scales, which might be a cross-cultural constraint upon music processing or reflect a more general limitation on memory for those who cannot effortlessly recognise the absolute pitch values (see Hauser & McDermott 2003). Taken together or independently, research on tonal appreciation and absolute pitch could afford a unique vantage point within a linguistic forum.

[11] This seems consistent with common composition practices of popular songs, the sale of which forms an industry that is financially on a par with pharmaceuticals in the United States (Mithen 2005). These songs are almost without exception written with diatonic scales exclusively, with minimal modulation between them.

2.7 Neural Organisation

The question of brain architecture is one of the primary scientific battlegrounds today and it is riddled with complexities. Having discussed a wide variety of material, at this point it is important to consider whether music-language relationships are mutually or distinctly expressed in the brain. One primary objective in discussing this complex organ is to show that the established cognitive neuroscience evidence from both music and language studies are reciprocally beneficial to portraying any thorough discussion on how the brain processes such highly structured auditory input. Moreover, the ever-increasing evidence for neurological music-language connections makes for a prime testing ground for those interested in supporting, challenging, or reconciling the theoretical ideology to which they subscribe. In accord with the proposed theories themselves, unfortunately much of this evidence is highly conflicting when considered collectively (e.g. double dissociation v neural overlap) and difficult to reconcile without forging a new theory. It is important to keep an open mind whilst the research methods and paradigms of cognitive neuroscience continue to develop.

Brain architecture is sometimes oversimplified into right and left hemispheric associations, grouping music with one and language with the other. This assumption is very problematic. Auditory and frontal regions appear to be just as essential for music processing as they are for all complex sound structures (Zatorre et al. 1994). Indeed, all sound is processed by "mechanisms for analysis of simple acoustic features (intensity, frequency, onset), complex acoustic features (such as patterns of these simple features as a function of time), and semantic features (learned association of sound patterns and meanings)" (Griffiths 2003). I have endeavoured to argue in favour of strong music—language similarities for the first two of these features. The obvious differentiation between the semantics of music and language could account for many of the divergences in neuronal processing.

Score reading and comprehension of melodic, rhythmic, and harmonic features of a piece of music have been shown to be processed in both cerebral hemispheres in a PET study with eight right-handed males (Parsons 2003). Studies involving lateralisation and handedness in response to audible musical stimuli have not only implicated Broca's area for musical syntactic processing, but suggest that Broca's area may be connected with timing and sequencing complex arm, hand, and facial activity (see Tervaniemi 2003). Indeed, music stimulates wide networks of bilateral activity throughout the brain (see Trainor & Schmidt 2003), with the laterality of hemispheric dominance allegedly capable of shifting, depending upon instruction and the degree of explicit musical training (Peretz & Morais 1987). It is the processing of pitch contour in the right auditory cortex that most suggests hemispheric specialisation (Liegeois-Chauvel 2003, Zatorre 1988). Peretz identifies this point as "the only consensus that has been reached today about the cerebral organization underlying music" (Peretz 2003, p. 200). She adds, however, that "it remains to be determined if this mechanism is music specific, since the intonation patterns of speech seem to recruit similarly located, if not identical, brain circuitries."

An argument on brain specialisation can be seen as essentially twofold. Though lateralisation does not prove specialisation, the possibility that the human brain is equipped with neural networks that are dedicated to the processing of music suggests that music has biological roots. If those biological roots overlap or converge with those networks used for language processing, then there would be serious implications for how to interpret Nativist theories of language (e.g. how unique the language faculty is). Pursuing this line of research is clearly beneficial to support or challenge such theories. Conversely, if the neural substrates of music or language are specialised, if they are not systematically associated with other cognitive domains or variable brain organisation, it may suggest that music is more of a cultural product and highly relative to the 'musical input'. A pre-wired musical brain would suggest a relatively fixed arrangement, and the brain's execution of music networks would be mostly the same cross-culturally and irrespective of musical knowledge. Most experts tend to agree that this has been quite elusive to confirm (see Peretz & Zatorre 2003). Both scenarios involve a serious examination of the origin and evolution of language (from both a phylogenetic and ontological standpoint) and in what capacity the language faculty converges with the 'music faculty'.

Perhaps the music faculty is a set of isolable processing components, each a potential candidate for musical specialisation. According to Fodor (1983), the characteristics of any mental module would include rapidity of operation, automaticity, domain-specificity, informational encapsulation, neural specificity and innateness. Domain-specificity is particularly salient here, as the bulk of the evidence to support the modular mind comes from reports on how congenital and acquired cognitive deficiencies manifest selectively against the language (aphasia) or music (amusia) faculties. There exist many documented examples of people whose brain malfunctions have discriminately damaged or preserved particular music abilities (Peretz 2002), or spared their linguistic abilities but not their aptitude for singing (Hebert et al. in press), or other forms of double dissociation between music and language.

For example, a study of 24 Broca's aphasics with severely impaired speech output revealed that 21 were still capable of singing, though to varying degrees of proficiency. Six could do so 'excellently' while others could only sing once they were assisted getting started, or sing but without words (Yamadori 1977). The retention of musical ability amongst patients with Wernicke's aphasia, including those with alexia and agraphia, is also common (Brust 2003). Evidence outside of cognitive impairment studies also confirms a dissociation between music and language. An fMRI study where opera musicians were asked to concentrate on either musical or linguistic components of the stimulus (a sung passage from different French operas) indicates that when listening to opera, we process both the lyrics and the tunes in an independent fashion, and the language is processed before the music (Besson 1998).

There are also instances of overlap in music-language processing that seem to contradict the idea of brain specialisation and modularity. Musical syntactic processing has been confirmed by neuroimaging research to activate known language areas of the brain (Maess 2001). Probably the most well-known example is the neural correlate between processing in linguistic and musical syntax. Known as P600 event-related potential (ERP), Osterhout & Holcomb (1992) found a positive brain potential which consistently peaks 600 milliseconds after the onset of a word that is syntactically anomalous. Patel et al. (1998) followed up this study from a musical perspective, finding that P600s of statistically indistinguishable correlations and distributions across the scalp were found in musicians as they processed syntactically incongruous musical chord sequences. Such sequences can only be recognised as incongruous in the first place because of the hierarchical organisation of pitches that is fundamental to tonal music, thereby facilitating a listener's perception, memory, and performance of music by creating expectancies that can be violated on a meaningful level (see Krumhansl 1990, Lerdahl & Jackendoff 1983).

In addition to these neurological convergences of structure, fMRI methods on harmonic processing have implicated both Broca's and Wernicke's areas (Koelsch 2002). Furthermore, the brain can encode and differentiate acoustically complex sounds regardless of the focus of the listener's attention. The changes in pitch contour are registered in the auditory cortex even in the absence of explicit concentration (Trainor et al. 2002) and without any conscious effort, musically untrained subjects may have neural mechanisms in place to extrapolate tonal harmony and sequential musical regularities (Tervaniemi 2003). If musical expertise does not guarantee facilitated neuronal processing of music sounds or sound sequences, the indication is that the process is seemingly unconscious and effortless, two words that are similarly ascribed to first language processing.

Evidence for a locus in the brain that specifically responds to reading music has proven to be difficult, suggesting an overlap with many parts of the task with word reading (see Nakada 1998). On the other hand, Sergent (1992) found that the 'translation' of reading music notation into gestural patterns on a keyboard activated cortical areas distinct from, but next to, those underlying similar verbal operations. This might explain certain types of amusia or selective linguistic disorders (where either language or music reading abilities would be impaired, but not both) because of the distribution and modularity of the neural networks involved. Examples of selective impairment are considered incompatible with claims that suggest music, speech, and environmental noises are perceived through a single auditory processing system. To address specificity of brain structure in language processing, there must be more meta-analysis of the results obtained across many experiments aimed at localising different areas of language and music processing. Such data in neuroimaging of music remain scarce (see Peretz & Zatorre 2003), though a dual approach in appropriate curricula might initiate more research interest.

From a developmental perspective, modularity may be instantiated in the brain during acquisition, with learning and memory mechanisms subservient throughout the procedure. The extent to which musical and linguistic processes are compartmentalised may be an emerging rather than innate feature of our ontogeny, as we cannot fail to recognise the similar developmental underpinnings in both domains (see McMullen & Saffran 2004). Brain specialisation for music may just result from "the recruitment of a free neural space in the infant's brain. Music could modify that space to adjust it to its processing needs and hence be associated to neural specialisation. This type of specialisation does not require pre-wiring. It may occur as a response to early cultural pressures" (Peretz 2003, p. 200). As suggested earlier, the extent that localisation varies capriciously across and/or within cultures could be relative to the meanings that are attributed to the languages and musical genres within the culture. Admittedly, these semantic and pragmatic meanings of language and music vary a great deal. This should not be a deterrent, but rather illustrate a necessity for further interdisciplinary collaboration.

How do music and language function in the brain, and what reliable conclusions can we draw from these functions? Questions of this sort are the most vital and highly contested considerations for winning favourable appeals in the empirical court, as the functions of the brain undoubtedly reveal many 'truths' about perception. However an examination of cognitive neuroscience is fraught with contradictions between the evidence in neuroimaging and neuropsychology, making it seem that the researcher can mount evidence to establish a stronger case for either dissociation or neural overlap. Additionally, the incorporation of both sets of data could introduce new cognitive theories[12] to challenge, for example, connectionist models of linguistic syntax that position syntactic representation and processing within the same network, and thus within the same neural network. Neurological comparisons between how music and language are processed not only are prevalent, but their due consideration is beneficial to the substantive case of all musicians, linguists, and neuroscientists.

[12] Patel (2003) offers such an amalgamated theory, one that is able to predict deficits in music processing for aphasics and interference between certain linguistic and musical syntactic integration tasks.

Chapter 3

Development: Experiment 1

3.1 Methodology

I would now like to direct my focus towards the way in which we ascribe meaning to a musical event once it has been processed. Here I will expound upon one innovative way in which the sound patterns of music, and their affiliate meanings, can be applied into existing linguistic theories. My discussion will engage both synaesthesia and sound symbolism, two potentially related linguistic subjects that, according to several scholars[1], contribute greater to clarifying the mystery of how language unfolded than normally assumed. In order to create a forum appropriate to these points of discussion, I performed a simple experiment, inspired by Ramachandran & Hubbard (2001) (*Kiki-Bouba Test* see figure 3.2 for original visual stimuli; see Köhler (1929) for the original experiment) and my own observations of the differing emotive effects of the major and minor modes in music.

3.1.1 Design

Participants were told they would hear a CD recording of two brief musical melodies. They were allowed to hear the melodies only once. After listening they were told two words, *kiki* and *bouba*, and their task was to state which word they believe corresponds to each melody. Participants were each tested individually via a *Goodmans GPS 155R* CD player (without headphones). They were not compensated financially

[1] Hinton et al. (See 1994), Hurford (See 2006), Ramachandran & Hubbard (See 2001)

for their assistance. In total, the entire test can be conducted in under five minutes per person.

The melodies were of my own composition, and were not designed with the linguistic stimuli in mind. The melodies, written in 3-part counterpoint, are identical in every way possible except for modality (D minor v D Major). Their length (28 seconds), articulation, dynamics, timbre (nylon string guitar), and melodic contour were indistinguishable to the extent that I was capable of making them so as a human performer[2]. On paper, written in standard music notation, the melodies appear exactly the same except for the prescribed key signature, which differs by three semitones (see Appendix A). The presentation of the musical stimuli and the order in which the words *kiki* and *bouba* were spoken was counter-balanced.

D minor: D E F G A B$^\flat$ C D

D Major: D E F$^\sharp$ G A B C$^\sharp$ D

Figure 3.1: The two modalities of the musical stimuli

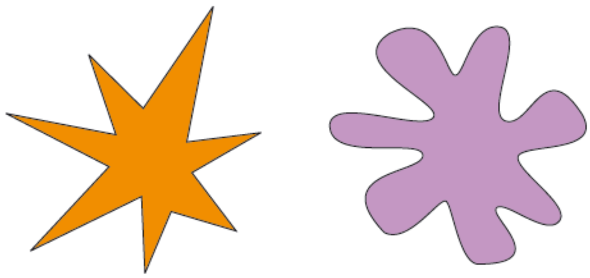

Figure 3.2: *Kiki* or *Bouba*? The two musical stimuli, using the modalities listed in Figure 3.1, replaced these two figures in the association task (from Ramachandran & Hubbard (2001)).

3.1.2 Participants

There were 20 participants in total, ranging in age from 21 to 55, with an average age of around 28 years. The gender ratio was 50 : 50. All participants said that they listened to music regularly when asked, thereby rendering a precise measure of

[2]Perceptually salient aspects of a melody, such as the modality, pitch contour, and temporal pattern, may play a vital role for prolonged memory of unfamiliar music (Dowling 1995).

their personal musicianship immaterial to the study. Indeed, it is likely that the implications of this study and its findings would become more robust if participants who were in no way familiar with the conventions of Western tonal music could be found. This would further isolate the musical and linguistic stimuli in the testing environment, and effectively decrease the amount of arbitrariness that could be attributed to the predicted association (e.g. *kiki* with the Major melody and *bouba* with the minor melody). This is one constraint placed upon the experiment, as it was conducted using subjects found both in the United States and Scotland.

3.1.3 Results

Of the 20 participants, 18 of them associated *bouba* with the minor melody and *kiki* with the major melody. In a phonetic sense, this would imply that they associated voiceless stops and high front vowels with the major melody, and labials and low back vowels with the minor melody. When asked, they said that their decision was made with certainty and without serious deliberation. They used words such as 'bright' (for the major/*kiki* melody) and 'dark' (for the minor/*bouba* melody) to describe what they heard. Those two who did not make the anticipated association did so in accord with the way the words made them feel, rather than responding to any phonetic inflection (e.g. subjective meaning was a more salient feature). For example, the word *bouba* was deemed more childish and thus associated with the 'happier' sounding melody, the one in a major key.

3.2 Discussion

What my experiment illustrates is that the presented melodies in the major and minor modes, the two primary modalities of Western tonal music, bear some sort of metaphorical resemblance to the phonetically contrasting linguistic stimuli *kiki* and *bouba*. I would like to motivate the idea that there is some sort of pre-existing, non-arbitrary correspondence between the word sound and the music. Possible explanations for this correspondence may come from research in the area of synaesthesia and sound symbolism.

3.2.1 Synaesthesia and Sound Symbolism

Though often regarded as an anomaly, synaesthesia has been part of our knowledge of the mind for a century (see Baron-Cohen & Harrison 1997). It is a sensory phenomenon where an otherwise normal person experiences something in a different modality from the modality of the event perceived, the effect itself being perceptual rather than based on, for example, memory associations from childhood. Synaesthesia has been noted across several modalities. For example, grapheme-colour effects form the most common documented occurrences (Ramachandran & Hubbard 2000), while certain musical intervals, as well as speech sounds, have been shown to induce involuntary sensations of taste (Beeli et al. 2005). Synaesthetes, as they are called, are also more likely to be involved in artistic pursuits[3] and seven times more likely to be female (Rich et al. 2005).

Fully developed synaesthesia runs in families, and its origins are assumed to derive from either the mutation of a specific gene (or sets of genes) or a chemical imbalance, both of which might lead to hyper-connectivity in neural regions that are normally sparse (Ramachandran & Hubbard 2005). Synaesthetes may be born with an impaired ability to appropriately prune the excess connections in the brain necessary to create the modular architecture for normal neural processing. The pruning capability is compromised and the synaesthete is subsequently endowed with excessive cross-sensory activation. The operative word here is ‘excessive’, since, for example, comprehension of metaphorical rhetoric is quite common amongst all normal functioning humans[4]. Attributing a synaesthetic effect to the results of this experiment might seem problematic in the sense that the participants are not synaesthetes themselves. Hurford (2006), however, has suggested the presence of a ‘universal weak innate synaesthetic disposition’ in early humans to help explain the necessary bootstrap for mapping meaning onto vocalisations. The idea that this cross-modal disposition remains latent within all of us to this day is well supported by the work of Vilayanur Ramachandran, who posits that we are all a little synaesthetic. He ardently supports the notion that synaesthesia has a neural basis that is represented in the brain, and then used as a foothold to explain the universal human ability to understand metaphors and other abstract concepts (Ramachandran &

[3]Nikolai Rimsky-Korsakov, Olivier Messiaen, Jean Sibelius, and Franz Liszt were all said to be synaesthetes (see Robertson & Sagiv 2005, p. 20-26).

[4]Interestingly, the generation of metaphors is not as common. Those who are good with such literary devices are often considered cleaver or witty.

Hubbard 2001, 2005).

There seems to be an inherent level of truth in this claim. For example, some word meanings do bear a natural connection with the acoustic properties of the auditory signal. This is a widely observed linguistic phenomenon that several scholars believe contributes a great deal more to explaining some of the mysteries of language than it is usually accredited with (see Hinton et al. 1994, Hurford 2006, Ramachandran & Hubbard 2001). Examples of sound symbolism have been found throughout many language families and at the most integral levels of the human lexicon. The words 'mother' and 'father' cross-culturally in relation to nasals and oral stops (Murdock 1959), female proper names in English (Cutler et al. 1990), deictic pronouns and place adverbs (Woodworth 1991), and personal pronouns (Traunmüller 2000) all demonstrate to some extent a relation between sound and meaning that appears to be not entirely arbitrary (see Hurford (2006) chapter 10 for a review). In brief, the idea of sound symbolism challenges the extent to which the sound of a word is arbitrarily associated with its referent (e.g. the Saussurian symbol). This implication reduces the unsolved mystery of how early hominids could have mapped sound onto meaning. Exploiting symbolic knowledge of the world could have been the bootstrap necessary for our ancestors to formulate, and then collectively move forward with learnt symbols. These symbols would subsequently become increasingly arbitrary, stylised, and subject to convention over the ages.

How is all of this represented in the brain? There are no definitive answers, though because of their respective roles in recognition and abstraction, the fusiform and angular gyri have been implicated in the involuntary metaphorical effects associated with a synaesthetic disposition (see Ramachandran & Hubbard 2001). However, because the fusiform gyrus is generally considered to process colour information, as well as face, word, and number recognition, and as its chief functions pertain to visual form rather than any abstraction from that form, it probably does not play an important role for the musical stimuli of my experiment.

Both sets of stimuli are auditory events however. As discussed in section 2.7, musical and linguistic processes could be, to an unspecified extent, modular in nature. Due to similarities in ontological development for both domains, this process of modularisation may be emerging rather than present from birth (McMullen & Saffran 2004). In this regard, it is interesting to consider at what point the child realises that musical sound and structures are couched in abstract and emotional content that we ascribe to them, rather than 'concrete' reference to entities in the world (such as with language abilities)[5]. In the event that children are not born with an innate awareness of this distinction, a latent, semi-modularised, semi-overlapping neural system of linguistic and musical organisation could emerge in tandem with the recognition of the semantic differences that separate music and language.

A pre-existing 'metaphorical auditory device' could be the result, brought on by neural cross-wiring between the various acoustic representations (both linguistic and musical) in the auditory cortex, and possibly the abstract functions of the angular gyrus. The angular gyrus has been implicated in the generation of abstract thought because it is located strategically at the crossroads of the temporal, parietal and occipital lobes and proportionately larger in hominids than other primates (Ramachandran & Hubbard 2001, 2005). A parsimonious solution for explaining the associations made by participants may be related to[6] musical intervals represented in a relative pitch space. The larger intervallic distance of a major third and the smaller distance of a minor third from a common tonic (C to E v C to E$^{\flat}$) appear to be associable with linguistic 'equivalents' within phonetic vowel space and consonantal articulation. This phenomenon is a very real and replicable event with an explanation that may remain illusory until a suitable origin of perceptual abstractions can be substantiated linguistically and/or neurologically.

3.2.2 Further Afield

The height of the second formant seems to be a consistent and empirically plausible measure of sound symbolism. In relation to the vowel quality of the utterance, an association is found with the proximity (high second formant) or distance (low second formant) of deictic and place adverbial meaning (Woodworth 1991). More general qualities such as 'small', 'weak', 'light', and 'thin' have been shown to be associated with high front vowels like [i] while qualities such as 'large', 'strong', 'heavy', and 'thick' are associated with back low vowels like [a] (Traunmüller (2000); or consider the jaggedness of *kiki* and the roundness of *bouba* in Figure 3.2). This is a widely reported phenomenon within and across many language families (Hinton et al. 1994)

[5] Music, like language, can be found in all cultures of the world Molino (2000), thus making such a consideration at least universally plausible

[6] Related, but not relative to. It would be inaccurate to argue in favour of an increased associative effect *relative* to an increase in size of the musical interval

and my experiment shows that this type of symbolism can be extended to include correlations between certain linguistic and musical events.

I mention these examples in order to facilitate the linguistic context of my argument, rather than suggest that spectrograph readings of musical tones be analysed as one would with vocal utterances. The hypothesis would be that the second formant of the major modality is higher than that of the d minor melody. This is highly problematic because the process of vocal articulation and the size of the vocal anatomy help designate the frequencies of the formants, the second formant being most sensitive to the body of the tongue (Sundberg 1977). The resonating chambers of each instrument, or the manner in which the tones are produced (plucked, bowed, struck, blown through, etc.) would change the formant frequencies irrespective of the key signature[7]. However, future studies in this domain of research may consider replicating a melody across several different instrumental timbres to see if an equivalent degree of confidence can be found in the association task.

In regard to the overtone series and its relation to the basis of tonal music (Bernstein 1976), it is worth noting that the major third appears as the fourth overtone in the series, whereas a pure minor third (relative to the fundamental) is not even produced by the series at all. This may be in some way relevant to the differentiations frequently made by participants when describing the major and minor melodies (e.g. 'bright' and 'dark', respectively). However, although an innate organisation of pitch structure may help form our understanding of tonal music, it is probably not a result of the natural harmonics that resonate proportionally over a given fundamental, as they do not correspond precisely with, for example, the Western system of equal temperament (see Lerdahl & Jackendoff 1983, p. 290-296).

3.3 Meaning

Like language, musical structure combines discrete elements to produce congruent, meaningful configurations. However, music is not meaningful in the same way that language is. It is non-referential and lacks 'semanticity' in the linguistic sense. And yet, it *means* so much to so many. It is a bold statement that would claim to characterise the meaning of music, but perhaps we understand music through the dynamics

[7]Personal correspondence with Dr. Bob Ladd: 14/8/06

that it shares with emotion. During the course of a composition, as sounds are woven together with volume and rhythmic contrasts, the listener discovers moments of musical uncertainty that evolve into expectancy for what is to come. Eventually they are resolved from the release of the pent up harmonic tension. Indeed this sounds quite like how emotions are induced by our perceptions of the world. Music can be employed to mimic the ebb and flow of emotional experience, thereby bearing a relationship to the emotion being expressed (see Meyer 1956, Langer 1942). And so while words *normally* bear an arbitrary relationship with the entities in the world to which they refer, music is self-referential[8], that is, referring to the emotional content that one has attributed to it, serving as a metaphor for the emotion itself. This would not have to be an entirely subjective procedure either. There is often a consensus upon the emotion ascribed, listeners generally agreeing on whether music is happy or sad (Terwogt & van Grinsven 1991). They generate physiological changes that are consistent with their emotional intensity levels, as measured by such indicators as arousal of heart rate, respiration, and blood pressure (Trainor & Schmidt 2003). People regularly provide similar anecdotal accounts of physiological changes[9] involuntarily induced by music they have experienced (Nyklicek et al. 1997).

Cross-culturally, Westerners and Indians are able to make very similar assessments of the emotional cues found in traditional Indian ragas, which are consistent with the intentions of the performer and composer (e.g. based on tempo and pitch changes (Balkwill & Thompson 1999)). In the event that these differing musical genres emerged and evolved independently from one another, further evidence for innate constraints on music perception would be provided. In relation to language, there is certainly interesting topics of discussion on whether an 'emotional mechanism' used in processing musical perception could have been inherited from the recognition of non-human vocalisations, known at least since the introduction of Darwinian theories to carry paralinguistic signalling of emotional states. Human vocalisations have emotional content encoded 'on top of' what is being uttered and interlocutors have perceptual mechanisms in place to respond to these signals. Musical perception, as well as the emotional influence associated with it, may in some way be affiliated with such early vocalisations and affect the way in which prelinguistic children comprehend the human speech pattern. This in turn may

[8]Meyer (1956, p. 35) said that 'music means itself. One musical event (be it a tone, a phrase, or a whole section) has meaning because it points to and makes us expect another musical event.'

[9]Such as shivers, tears, laughter, and ecstasy

go a long way in explaining our choice of metaphorical language that we regularly attribute to music, or why there is something inherently *bouba-ish* about the major melody in my experiment

I can sympathise with the linguist who fails to see the linguistic relevance of discussions on the comical tendencies of Haydn, irony in late Beethoven string quartets, the portrayal of love and loss in Berlioz' *Symphonie Fantastique*[10], or how deceptive a deceptive cadence can be. However, if rhetoric is any indication of truth, then we should remember that linguists draw metaphors with music all the time as well. Speech intonation is often referred to as 'speech melody' by linguists and phoneticians ('t Hart et al. 1990) and DeCasper (1994, p. 163) describes prenatal exposure to maternal speech as 'language-relevant perceptual tuning before birth'. Similarly, musicians[11] have studied and notated prosodic features to marshal their inspiration for compositions (see Anhalt 1984). Metaphorical phrases and comparative expressions for ease of communication may not be conclusive evidence. Nevertheless, their prevalent use is a reflection of our experience with the world. At least to that extent, they reveal grains of truth.

Scratching the surface of the 'musical grammar' metaphor, that is, moving beyond the structural architecture and scientific principles of auditory perception, one finds that the flexibility and ambiguity of musical conventions are crucial in allowing one musical event to elicit multiple interpretations (Aiello 1994). Though an ambiguous sentence like 'The man chased the dog with a stick' does not have an exact equivalent in music, music can still be ambiguous because it clearly means and refers to *something*. "Music's lack of referential meaning may allow listeners of all ages to engage in some form of social or pretend play, projecting imaginative fantasies onto the musical forms that they hear, and forging interpersonal bonds in the process" (Patel 2003, p. 676). What makes music so fascinating might actually be its vague meaning, an idea that will always be central in musical aesthetics, and always a determining differentiation in linguistics.

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[10]That is, without having read the title of the movements in the concert programme

[11]Consider Berio's *Sequenza III*and work from Czech composer Leos Janéŏek

Chapter 4

Recapitulation: Experiment II

4.1 Introduction

A wide variety of topics relevant to a robust interdisciplinary linguistic and musical research programme have now been discussed. The questionnaire form employed in this second experiment is the vehicle by which I will assess and analyse the academic consensus or disparity on these points (see Appendix B for a complete copy of the questionnaire). As I have endeavoured to show, traditional core components of any linguistic inquiry, at all levels of examination, offer far more than just superficial connections with musical events. However, the lack of musical discussion in the linguistics classroom that I have observed, and infrequent application of musicology within linguistic theory and literature[1] illustrates the great epistemological division that separates the two fields. The questionnaire is designed in an effort to explore the divisions that are most irreconcilable and identify any misconceptions that may result from a cursory understanding of a second discipline.

4.2 Methodology

As the majority of curricula, theoretical formulation, grant proposals, novel research, and implementation of publicly accessible, well-formulated ideas on music or language stem from university academics, I felt it imperative to explore how much

[1] The inverse could also be said of musicians, though as stated earlier, I have restricted the scope of my argument to linguistics.

cross-disciplinary agreement exists between them. A clear identification of converging and diverging themes in the two fields is pivotal in order to nurture a healthy and open dialogue. The questionnaire form strives to achieve this end, as well as other purposes as follows.

4.2.1 Objectives

- The questionnaire helped establish the forum for which I was able to address a wide range of music-linguistic correlations and divergences, the body of this dissertation itself being an expanded form of the content of the questionnaire. Such issues have been central to my academic pursuits for a long time and require resolve.
- The questionnaire promotes awareness of music-language themes to those who have considered its content. Some participants may not be aware to what extent, and in what respects, empirical evidence corroborates a more than superficial relationship between music and language. An exhibition of such evidence, even if it is not believed in its entirety or without condition, could inspire members of the field to contemplate the ramifications of such a relationship in future research, theoretical development, and both formal and informal discourse.
- I recognise that the modern paradigms and experimental methods that are increasingly employed to make significant advancements in the linguistic domain are technologically based (e.g. computational models and processing, genetic decoding, brain mapping). Given that the aim of scientific research is to persuade in the light of new evidence, I chose a methodology that was readily attainable and capable of fulfilling the above criteria. Just as a composer may be inspired to write a symphony, but not having access to an orchestra, reworks the piece into a piano sonata, I wanted to work effectively within my means.

4.2.2 Procedure

The entire questionnaire was administered in two formats, both of which maintained an anonymous association with the participants[2], aside from their indication of academic status. For those within the city of Edinburgh, I distributed a printed copy in a self-addressed stamped envelope that was filled out at the participant's leisure and posted to my home address. 80 such questionnaires were distributed and 36 (45%) were returned. For those abroad or inaccessible, I sent the questionnaire electronically with the request that they return it to a third party email where I accessed the completed form, attached as a Word document, via a colleague who kept the identities from me. I have no way of accurately knowing how many people received this email because I sent my notice out *en masse* to groups of academics (for example, all PPLS and music students at the University of Edinburgh) and encouraged many others to share the questionnaire with anyone who fulfilled the necessary requirements. Data was compiled and statistically analysed on SPSS (See the data spreadsheet in Appendix C).

4.2.3 Participants

The target participants for this research are necessarily university academics because no study of this nature, with the intended objectives as stated, could come to fruition without probing the active members of the linguistic and musical fields themselves. Additionally, rather than just dividing the research into a musical and linguistic distinction, I have chosen to supplement my analysis by further dividing groups into the teachers/researchers that shape the curriculum and research, and the students that may one day inherit this position. Thus, there are four sets of participants comprised of students or teachers of either linguistics or music, forming a total sample of 53 people. That number is broken down into 35 linguists (19 students and 16 teachers) and 18 musicians (10 teachers and 8 students). It is a partial constraint on the results of the experiment that almost twice as many linguists responded than musicians. A greater response from linguists was probably the result of my current affiliation with the linguistics department at Edinburgh University.

[2] It is likely that most of the participants were in some capacity acquainted with me. This was a practical constraint imposed upon the study by my efforts to locate willing and eligible subjects.

4.2.4 Design

The abundance of concentrated comparisons that I have already outlined in the Exposition and Development essentially form the content of the questionnaire itself. I endeavoured to cover as broad of a scope on the question of music-language correlations as possible, thus imposing few theoretical and investigative restrictions on the design.

Part IA of the questionnaire is different from those which follow because it explores the relevance of music and language respectively across the coursework of the discipline where it is normally absent. In other words, linguists are asked to indicate the three subject areas (from a list of ten) that they believe share the most relevance to music and the three areas that they believe share little or no connection with music. Musicians are asked the same in regard to the relation between language and their subject areas. Subject areas were chosen in accord with what I perceive to be traditional core courses of a music and linguistics degree programme. All subsequent parts of the questionnaire are identical for both groups of participants.

Additionally in Part I, there is a B section that tests terminological knowledge by presenting twelve pieces of salient vocabulary, six of which relate directly to linguists and six that relate to musicians, all of which would be fitting within any interdisciplinary discussion of the two subject areas. Participants were asked to state either *yes* or *no* as to whether they could provide a working definition of the term. As anyone who engages in a new field of study will know, one of the first and foremost complications with processing the germane literature is the identification, comprehension, and application of the discipline's vocabulary. The linguist or musician who shares the prerequisite common knowledge in the other field should be capable of giving a working definition for most of these terms.

Part II is composed of four subsections: eight questions on *Acquisition and Development*, six under the heading *Organisation and Meaning*, four on *Processing*, and five concerning *General and Hypothetical* issues. Each division contains several declarative sentences on a variety of topics pertinent to the subsection heading. All statements are grounded in known literature, such as those listed in part IV, and have an empirical basis (excluding those statements which are hypothetical and general). On a scale from one to five, participants determined how much they agree or disagree with the statements, true to their own judgements and current linguistic-musical knowledge.

Part III is similar to the theoretical design of Part II, though measured in a multiple-choice format. For all but one question (a question on the evolution of music and language), participants make their decision based on a *more than/less than/equal to* basis, or else opting out by not commenting.

Part IV concerns the literature and pedagogical theories in which the preceding statements are grounded. This section was intentionally placed towards the end of the questionnaire in an effort not to bias participants in Parts II and III. Being presented with such a list of existing literature, and thus with the suggestion that the statements found in Parts II and III are grounded in published empirical research, might influence the level of willingness to agree. The primary objective of this section is to provide a window into how much concern is afforded the works that straddle the two fields. There are seven books, two teaching methods, and one specific journal publication, and participants are to acknowledge their level of awareness or ignorance of the works cited based on a four-point scale.

The analysis of Part V is purely qualitative and I have made some of the more notable responses available in Appendix H. Here, participants were able to respond as they wish to the statement, 'Music is like a language'. I think there is much to learn from how academics candidly react to this well-worn axiom. The linguists and musicians were additionally asked to, respectively, indicate their level of musical (proficiency on an instrument, formal music instruction) or linguistic (level of fluency in a foreign language, linguistic knowledge) influence. I felt this inquiry useful not for statistical reasons, but rather to overtly connect the participant with their own musical or linguistic experience, now having already considered the content of the questionnaire. If interested, participants were also able to include additional comments or qualify any of the material that has already been discussed in this or previous sections. I wanted to include this option because I recognise that the statements in Parts II and III may oversimplify complex issues to a group of people that are highly knowledgeable on some of its content.

4.2.5 Predictions

The two null hypotheses for this experiment are first, that linguists and musicians hold similar opinions on and interpretations of music-language considerations, and second, that both groups, as well as their further division by academic status (teachers and students), are of a similar theoretical mindset. Due to the design of the questionnaire, being comprised of several sections, each consisting of diverse individual statements and disciplinary implications, it is difficult to gauge at what exact point these null hypotheses can be rejected[3]. However, if a *notable* divergence from their predicted outcome is observed, such a finding would suggest that interdisciplinary difficulties (e.g. lack of open communication, research incentives, available time), prevalent misconceptions (e.g. lack of knowledge on literature and research, terminology, etc.), and empirical difficulties[4] are primary obstacles.

4.3 Results

The results that emerged from this sample of academics indicate that there is not a sufficient basis of cross-disciplinary knowledge and empirical agreement between groups. Additionally, linguists appear to be more of a like mind collectively than musicians, including when partitioned by academic status. In accord with the divisional format of the questionnaire, each section examining different facets of musical-linguistics integration, I will discuss the results in the order which they appeared on the form. It would be useful for the reader to become familiar with and refer back to the questionnaire itself, which can be found in Appendix B.

4.3.1 Part IA

Both teachers and students of linguistics clearly indicated that a discussion of music is most relevant within the topics of Prosody, Phonology, and Syntax (see Table 4.1). There was an equal tally for the subject areas that bear little or no relevance to music, namely, *Semantics*, *Pragmatics*, and *Visual Word Recognition* (see Table 4.2).

[3]Especially for Parts II and III, as Parts I and IV indicate their findings by tallying the responses.

[4]Such difficulties being readily addressable by individual evaluation and/or additional innovative research

Relevant Subject Area	Ling. Students $N = 19$	Ling. Teachers $N = 16$	Total $N = 35$
Prosody	19	16	35
Phonology	12	10	22
Syntax	9	11	20

Table 4.1: Most relevant linguistic subject areas for discussion of music

Irrelevant Subject Area	Ling. Students $N = 19$	Ling. Teachers $N = 16$	Total $N = 35$
Semantics	9	10	19
Pragmatics	9	10	19
Visual Word Recognition	11	8	19

Table 4.2: Least relevant linguistic subject areas for discussion of music

The results from the musicians were not as decisive as the linguists, with all ten subjects areas being designated at least once as both relevant and irrelevant. However, what I find intriguing in Table 4.3 is that musicians consider Sight Reading as a potentially suitable subject area for integrating linguistic theory, though linguists consider music as irrelevant to the study of Visual Word Recognition. Further, Perfect Pitch was regarded by the musicians (see Table 4.4) as the most irrelevant subject areas for linguistic theory even though current research of the available literature has suggested to me that it might be one of the most promising (see Section 2.5). The total tally for both groups of participants is available in Appendix D.

Relevant Subject Area	Music Student $N = 8$	Music Teacher $N = 10$	Total $N = 18$
Composition	4	4	8
Music Theory	4	4	8
Sight Reading	3	3	6

Table 4.3: Most relevant musical subjects for discussion of language

Irrelevant Subject Area	Music Student $N = 8$	Music Teacher $N = 10$	Total $N = 18$
Perfect Pitch	4	6	10
Acoustics	5	3	8
Solo Performance	4	2	6

Table 4.4: Least relevant musical subject areas for discussion of language

4.3.2 Part IB

Tables 4.5 and 4.6 show two groups of terminology; those terms directly related to linguistics and those directly related to music. Both groups of terminology would be relevant to any interdisciplinary study of music and language. Percentages show the amount of participants who would be able to provide a *working definition* of the given term.

There are two total averages provided, the second of which I believe is more representative as it is to the exclusion of the least understood term for each group (*Ambient Language* may have been misunderstood out of a context (e.g. the ambient language of a community) while *Schenkerian Analysis*, though still language relevant, is an advanced level theory in music). The removal of these outliers reveals that linguists fare only slightly better than musicians with intra-disciplinary (90% v 86%, respectively) terminology. For cross-disciplinary terminology, both groups are below 50% in providing working definitions for terms (49% v 41%, respectively).

4.3.3 Part II

A Chi-Square non-parametric test, which measures whether the observed frequencies of a variable differ from what would be expected if all choices were equally likely to occur, is a well suited *preliminary* test for the design of Part II. The questionnaire in Part II requires participants to state how much they agree or disagree with each of twenty-three statements on a five point scale. However, in order to eventually make an adequate comparison between-groups, all variables must first be tested within-groups to locate those variables that show a general consensus, whether of agreement or disagreement. Variables that can not falsify the null hypothesis represent discord within the sample group for that particular statement, rendering them problematic

Terminology	Linguists $N = 35$	Musicians $N = 18$
Universal Grammar	97%	28%
Phoneme	100%	39%
Recursion	86%	33%
Tone Language	97%	50%
Formant	71%	56%
Ambient Language	31%	17%
Total Average	80%	37%
Total w/o *Ambient Language*	90%	41%

Table 4.5: Knowledge of a 'working definition' for common linguistic terminology

Terminology	Linguists $N = 35$	Musicians $N = 18$
Harmonic Analysis	34%	83%
Atonality	37%	83%
Metre	63%	83%
Relative Pitch	69%	89%
Schenkerian Analysis	3%	61%
Overtone	40%	94%
Total Average	41%	82%
Total w/o *Schenkerian Analysis*	49%	86%

Table 4.6: Knowledge of a 'working definition' for common musical terminology

for a parametric comparison of means test between groups. The first Chi-Square test conducted revealed five such variables amongst musicians and zero amongst linguists (see Table 4.7).

Variables number 4, 10, 11, 16 and 23[5] show that the musicians sampled do not tend to agree with each other on how to interpret the declarative statements that these variables represent[6]. The higher the decimal number, the larger the variation in response is from the participants. At the same time, the significance values for all variables in the linguistic sample were below .05, indicating a relatively homogeneous opinion.

[5] Numbers assigned in order of appearance in Part II of the questionnaire

[6] A Levene's Homogeneity of Variance test confirmed that these variables, as well as an another variable (variable 5:*Innateness*), could additionally reject the predication that their variances between-groups were significantly equivalent to conduct a one-way analysis of variance test (see Appendix E).

Group	Variable from Questionnaire				
	4: *Birth*	10: *Function*	11: *Emotion*	16: *Reading*	23: *Reference*
Ling. $N = 35$	–	–	–	–	–
Music. $N = 18$	$p = .311$	$p = .635$	$p = .136$	$p = .311$	$p = .926$

Table 4.7: Chi-Square Test 1: Five variables identified: Musicians had mixed opinions ($p = .05$) on how to interpret these statements. The words beneath the variable numbers offer a brief description of that statement.

A second analysis was conducted to see if such discrepancies existed within the groups, between the teachers and the students (see Table 4.8). This Chi-Square analysis[7] quite clearly confirmed that linguists, both as a group and when divided by their academic status, tend to be more of a like mind than musicians. Academic status does not appear to be a major determiner for within group variation of opinion.

Group	Amount of Variables Over $p = .05$ Significance Level
Linguistic Students $N = 19$	2
Linguistic Teachers $N = 16$	4
Music Students $N = 8$	17
Music Teachers $N = 10$	14

Table 4.8: Chi-Square Test 2: Within Groups – Students v Teachers

The previous tests were conducted in an effort to minimise the potential for type-II errors and to isolate those variables that suggest discord in opinion *within* groups. Ultimately, to explore whether musicians and linguists disagree with *each other* in regard to the variety of propositions made about music-language connections, an ANOVA test was conducted. Of the 23 variables, 17 of which possess a suitable distribution for this test, 10 were found to yield means that were statistically significant. All results for the tests conducted for Part II can be found in Appendix E.

- 1: *Exposure to music accelerates the acquisition of a first language.*
  $p = .005$, Mean L: 3.05 M: 3.83
- 3: *The utterances directed towards and heard by pre-linguistic babies should be*

[7] In terms of the level of variation found within-groups, all of the linguistic variables in this table were still below $p = .2$ whilst 5 of the 17 and 3 of the 14 variables for musicians surpassed $p = .5$.

considered both as musical input and linguistic input.
p = .000, Mean L: 2.86 M: 3.94

- 6: *Acquiring a second language assists with the study of music.*
  p = .001, Mean L: 2.69 M: 3.61
- 7: *Studying music assists with the acquisition of a second language.*
  p = .003, Mean L: 2.91 M: 3.78
- 12: *Spoken language is both manipulative and referential while music is principally manipulative.*
  p = .002, Mean L: 3.46 M: 2.56
- 14: *Like language, musical phrases can be embedded within other similar musical phrases, enabling the generation of an infinite range of expressions from a finite set of elements.*
  p = .054, Mean L: 3.77 M: 4.28
- 15: *Language and music overlap in important ways in the brain, and thus studying the nature of this overlap can help illuminate interesting features about the functional and neural architecture of both domains.*
  p = .003, Mean L: 3.42 M: 4.17
- 18: *Given that children use categorical perception to learn the phonology of their mother tongue, this same ability could be used to develop accurate pitch discrimination/identification if the child received adequate musical exposure.*
  p = .042, Mean L: 3.23 M: 3.72
- 20: *The general population has a better conscious understanding of how language works than how music works.*
  p = .018, Mean L: 3.00 M: 3.83
- 22: *If humans were able to hear but not speak or produce any noise from their mouths, a highly developed musical language would emerge in addition to gestural systems of communication.*
  p = .010, Mean L: 2.74 M: 3.39

4.3.4 Part III

A Chi Square test was also employed in Part III. The variables were gauged on a more-less-equal scale only, as I limited the range of the test to exclude those who chose not to comment. The responses for variables 1 and 5 for linguists and variable 6 for musicians were found to be too diversely disseminated to yield any reliable conclusions, having a significance value above P = .05 (see Appendix F for all significance values)[8]. The average responses per group for the remaining four variables are shown in Table 4.9.

Variable Number and Grouping		Linguists	Musicians
2-*Motivation*	More	30%	6%
	Equal	70%	89%
3-*Rhythm*	More	75%	47%
	Equal	25%	53%
4-*Empirical Evidence*	More	54%	29%
	Equal	46%	71%
7-*Cognitive Deficiencies*	Less	31%	13%
	Equal	67%	81%

Table 4.9: Part III: 'Importance' Percentages

Variables 3 and 4 illustrate a discrepancy between linguists by evidence of the majority percentages being found in opposing rows. In other words, variable 4, which questions how important empirical evidence is for making advances in linguistic studies as compared with music studies, reveals that 71% of musicians feel it is of equal importance whilst 54% of linguists believe it to be more important to the linguistic field. This notion could have vital implications for the interdisciplinary credibility of musicological evidence if this sample is representative of the greater population of academics.

Additionally in Part III, variable 8 presented five viable scenarios (four statements and one choice marked 'other') for how music and language may have evolved. Although the responses were as widely varied for both groups as the eligible scenarios in the questionnaire, what is noteworthy is that 11 linguists (31%) selected 'other', as compared with only 1 musician. It would seem that the musicians were relatively

[8]Variable 5 for example was at .651, indicating a vast variation in outlook.

content with the possibilities presented whereas the linguists envision an alternative scenario, though it is unclear what it would be given the available options that were rejected (see Appendix F). Part III, like Part II, reiterates that musicians and linguists are not of a similar mind on many empirically and theoretically grounded points of discussion central to an interdisciplinary music-language curriculum.

4.3.5 Part IV

Knowledge of relevant literature in a given subject area is integral to the understanding of that subject. Part IV attempts to establish how aware musicians and linguists are of works and methods that are of significance to interdisciplinary research on music and language. The ten items listed below were selected because they are examples of seminal contributions to this realm of academia and likely to be encountered by interested scholars. Table 4.10 shows the total percentages of those who have *never heard of* the given item, this level of awareness being the clear majority for the sample. Results indicate that musicians were more knowledgeable of these methods and published works than linguists, though both groups appear to be overall unacquainted with the material.

Literature/Method	Linguists N=35	Musicians N=18
Generative Theory of Tonal Music	63%	44%
Cognitive Neuroscience of Music	91%	78%
Psychology of Music	91%	28%
The Musical Mind	83%	44%
The Singing Neanderthals	63%	72%
Emotion and Meaning in Music	89%	33%
The Language of Music	86%	28%
Suzuki Method	51%	0%
Suggestopedia	86%	94%
Nature Neuroscience July 2003	80%	94%
Total	78%	52%

Table 4.10: Part IV: 'Never heard of' Percentages

These results suggest that a majority of music-language similarities and differences, such as those statements deliberated upon in Parts II and III, are evaluated predominantly by a participant's intuitions and knowledge of their field of expertise, rather than salient literature (see Appendix G for a complete listing of results).

4.3.6 Part V (see Appendix H)

4.4 Conclusions

Part IA identified those subject areas that linguists and musicians believe to be the most and least relevant to an interdisciplinary music-language discussion. Those subject areas of relevance offer the best promise for the curricular integration that I am proposing. Parts IB and IV, illustrate that fundamental obstacles (knowledge of terminology and salient literature) to learning across these different disciplines do exist. The vocabulary of scientific branches do not map easily onto one another, yet mastering the common vernacular of a field is crucial to understanding it and being understood in it. Experimental and observational reports that are couched in decidedly theoretical language become rendered almost inaccessible to people outside the field. Integration of the readings and methods listed in Part IV into a linguistics curriculum would not be difficult to do, nor in any way extend beyond the limitations of a thorough discussion on core linguistic areas. Suggestopedia, for example, is an officially tested, UNESCO recommended[9], second language teaching method that uses music as a fundamental component of its pedagogy. *A Generative Theory of Tonal Music* is co-authored by Ray Jackendoff, an accomplished linguist whose work is often cited. All of the above works have comprehensive, empirically grounded sections detailing much of what the body of this dissertation has discussed as well as many other linguistic relevant points of interest.

Parts II and III illustrate just how varied opinion and inference can be within and between two disciplines. Musicians especially were found to have a large range of contrasting opinions amongst themselves. Ten of the statements in Part II (43%) were found to yield statistically significantly results between musicians and linguists. Thus, despite the academic merits or fallacies associated with the statements listed in Section 4.3.3, the opinions of those university level musicians and linguists sampled were found to be in discord about how to interpret them. Six statements (26%) were diversely answered within groups (with another four (50%) in Part III), serving as

[9]See: *The Journal of the Society for Accelerative Learning and Teaching*, 3, 1978 p211.

a reminder that these decisions are first and foremost made at the individual level. The same can be said of those participants who *were familiar* with the literature and pedagogies in Part IV. All academic disciplines are comprised of individual people, thereby imbuing any collective assessment of an academic discipline, no matter how rigorously undertaken, with the subjective qualities of an individual whose opinions do not necessarily conform with a general field consensus.

Without passing judgement on the participants and the fields they represent, it is safe to say that musicians and linguists are of a different mind on how to address, interpret and respond to music-language considerations. Furthermore, this appears to be true despite the amount of empirical validity that supports or denies such considerations. The way forward, however, is not complicated nor time consuming. One hour of class time during the course of a semester, or one literary reading out of twenty dedicated to this topic may be the catalyst that inspires someone to seek further information on this intriguing subject. Music has the benefit of being an interesting topic by nature. The average linguistic scholar is probably willing to examine in what context it can be incorporated with their language pursuits. Further afield, as more research appears and more plausible 'answers' are put forward, and I believe that it is only a matter of time, such considerations would become vital to any linguistics curriculum.

4.5 Discussion

At the heart of this dissertation is interdisciplinary research. I would now like to turn to the university system from which the sample of my questionnaire was selected in order to discuss some concerns for effectively implementing such a pursuit. Linguistics as a field champions itself as multi-faceted in scope despite the general absence of musical consideration within its curriculum. In the light of the mounting body of evidence that suggests strong links between music and language, this is quite paradoxical. The dynamic conventions of language, as well as music, will directly pertain to or manifest within a wide array of subject areas, most notably psychology, neuroscience, biology, and philosophy. A discussion of the possibilities and pitfalls of a joint academic venture is warranted. Organisation, incentives, and pedagogy play central roles in determining how the education, publishable research, and general perceptions held by members of the field will be established and then implemented.

4.5.1 Interdisciplinarity

I have identified three potential obstacles within the overall academic system that impede interdisciplinary work, all of which unfold within a dynamic educational system dominated by time, effort and funding. First, there are *departmental boundaries*. Though perhaps historically interdisciplinary work preceded the singular discipline, today it seems that academic boundaries are not only the norm but quite curricular and administrative in nature, as well as symbolic for the identity of staff and students alike. It is a territory, forming part of an overall hierarchy running from the School level to the Faculty to the Department to the Degree Programme to the actual Course where the material is taught[10]. The fortification of and stringent adherence to this boundary may vary from discipline to discipline.

The notion of integration between music and language raises the question of whether the disciplines would form a loose federation or a pluri-disciplinary package. The former offers more juxtaposition than assimilation and the latter suggests the necessity for the creation of a new department. If a new department is not formed, there are additional prerequisites to set in place such as appropriately crediting teaching hours or ensuring as much financial autonomy for the interdepartmental course as possible so that it would not be constrained by separate administrative budgets.

The second dilemma for the interdisciplinary academic is to consider the possibility of *professional risk* that would inhibit such non-specialised endeavours. Pressure of this type may explain the ubiquity of departmental boundaries. Though some may find this pressure to be exaggerated, the doubt that an individual may have as to whether the existing boundaries should be adjusted could be deeply instilled by the available career prospects and academic traditions of an institution.

> The university teacher judges his expertise and receives his esteem and rewards for the most part within the framework of one subject. His courses and examinations belong to the traditions of that subject, his publications are judged by other teachers in that subject, he attends its annual conference and, if he is successful, he is promoted through a small and fairly familiar peer-group to a chair from which he continues to organise the teaching of the same subject. There are great penalties attached to breaking out of this cocoon into an insecure world of fewer peers, fewer conferences and fewer senior posts and the best and most confident of teachers is quite justified in looking very hard at what sort

[10] Dr. April McMahon, head of the PPLS department at the University of Edinburgh, referred to this as a 'wedding cake' structure (personal correspondence 20/3/06)

> of prospects the system offers him once he casts aside his subject label. (Squires 1975, p. 23).

From another perspective, that which the teacher deems appropriate material for a course curriculum, assigned reading, or research project will inevitably reflect upon a student's understanding of what is deemed a relevant point of discussion. At the same time, the structure of a research council tends to move along subject lines, which complicates any sort of financial incentives[11] that might entice academics to test how pliable the boundaries are. Though higher-up university authorities and research councils may be keen on interdisciplinary work, those proposals that blend two disciplines may also face scrutiny from two committees. Ultimately, there does not seem to be any inherent interdisciplinary motivation built into any partitioned academic system. It is the academic zeal and commitment that the individual is already predisposed to invest that allows interdisciplinarity to materialise.

A third problem is a familiar antithesis. Is *specialisation or general education* more beneficial? Should one prefer breadth to depth? Time is obviously an issue if music is integrated into a linguistic curriculum. Something would naturally have to be removed or discussed in less detail in order to accommodate. Certainly a well-rounded education can make for a better specialist, though an institution that caters to breadth may compromise the student's expertise in the field. Breadth will also demand broader academic interest[12] on behalf of both the students and teachers. This is more of an intra-departmental concern, which is a difficulty that is compounded further by a field like linguistics that appears to be divided into diverse theoretical factions. One good question to ask is whether linguistics is a subject chiefly aligned with the departmental values of the humanities or natural sciences. Pullum (1991, Ch. 21) presented such a hypothetical case.

> **Humanities:** To think of the study of language being separated by major disciplinary and administrative boundaries from poetic analysis, or philosophical logic, or classics, or the study of modern languages, is a manifest absurdity. p. 185

> **Natural Sciences:** Modern phonetic research demands highly advanced laboratory equipment for wave-form display and manipulation, acoustic analysis, and computer simulation, and relates to physics more closely than to any other domain. p. 187

[11] Research Assessment Exercises also weigh in for both publications and finances.

[12] This demand is often placed upon the student working for a liberal arts undergraduate degree, though may be more problematic with traditional post-graduate level ideology (e.g. specialisation).

His commentary shows just how polarised the humanities and sciences can be. They are often distinguished by both their subject matter and the philosophical preferences for either humanistic or mechanistic conceptions, which in turn comes to bear upon the circumstances[13] surrounding the methodologies employed, rather than the other way around. Scientific conduct gains the connotation of being sensible and praiseworthy while unscientific behaviour is deserving of contempt. The perceived validity to which each is able to explain the world would be compromised rather than unified. Apparent music-language connections would be shrouded in doubt before the idea is even considered on an empirical level if such a schism exists. Ultimately, both academic areas stand to benefit from their mutual awareness, especially if increased specialisation is the only other alternative.

[13]E.g. volume and quality of data available, risks involved with erroneously falsifying a null hypothesis

Chapter 5

Coda

Hudson (1981) empirically collected 83 statements that all linguists could agree upon. 25 years later, it would be interesting to consider whether that number has gone up or down. The fact remains that there are many prevalent linguistic theories[1] that are collectively irreconcilable due to the substantive cases they put forward. Unfortunately not everyone can be right. Perhaps there are many prevailing theories in linguistics because of the volume and quality of accessible data. The ideal of theory-neutrality[2] is very much in question and since data is incapable of speaking for itself, an existing set of pure data that all scientists could accept despite their theoretical allegiances remains illusory. Especially in a discipline such as developmental linguistics where it is prudent to seek descriptions that hold true for all the world's languages, to propose a theory that is functional only in certain instances is to abandon universality as a possibility. Theoretical opposition might be an indication of a healthy debate that is going on in the civil forum of disagreement that is 'academia', but it definitely denotes that additional theories or appendices to existing theories should not be excluded from germane points of discussion. Until linguistics as a field can reach a stronger consensus upon what can be taken as given, there is no viable contention to be made that should exclude the mounting musicological evidence that correlates with linguistic phenomena. So if the aforementioned research in favour of music-language connections fulfils a criterion of relevance to the subject matter, there must be additional theoretical and epistemological reasons as to why music goes under-appreciated.

[1] E.g. Nativism, Socio-cognition, Connectionism, Evolutionary differences, etc.
[2] see 'Theory-ladenness' (Kuhn 1962)

If indeed the aim of science is to persuade in the light of new evidence, the onus as to why music remains under-appreciated falls to those researchers who would dismiss these music-language similarities as anomalies[3] or ill-suited features of a parsimonious explanation. Contrary to Ockham's razor, the simplest answer may not be the best one. Consider, for example, the proposition that the continents of South America and Africa were once geographically touching one another. On the surface, this idea seems patently absurd[4]. Nevertheless, it is a credible theory that is supported by evidence and detailed explanations.

Now consider the idea of correlating music with sound, structure, and meaning, the three essential components of Language proper. First, if we are to consider sign language as a fully developed linguistic system, which virtually every linguist does, it would seem that sound, or even the auditory reception (hearing impaired) or production (mute) of sound, is not a 'prerequisite' for qualification as a language. But most language is spoken, just as all music is audible[5]. So let's consider the immense variation in vocalisations employed at the phonetic, morphosyntactic, and/or lexical levels in the many tongues of the world. Or let's consider phonological features such as tone, clicks, and voice quality that allow for different communicative dimensions by which to produce minimal pairs and pragmatic speech acts. It seems a bit of an oversight to suggest that our phonological capabilities would not extend in the same way, given the differences in input, to complex pitch discrimination or tonal and cultural preferences of musical constructs. Second, the recursive, hierarchical, and overall ordered characteristics of music that I have illustrated are apparent with minimal explicit examination of a musical composition. Whether it is the isochrony of a fundamental rhythmic pulse or the complex 'grammar' of Baroque fugal technique, music has unhindered potential for both order and freedom of expression alike. I have divided this paper into sections named after the divisions of Sonata Form in an effort to encourage this idea of form and structure. Whether a musical phrase is well-formed can be dictated stylistically[6] or displaced by the tastes and preferences of the listener, which may be innate, subjective, or acculturated.

Language is a social phenomenon, involving semantic and pragmatic implications

[3]Kuhn would probably refer to this as the 'preservation of normal science.'

[4]And at least 14 Creationist academics currently in the science departments of several British Institutions would agree (*The Times Higher Education* July 2006 p1)

[5]John Cage might disagree with this point (see 4'33").

[6]E.g. forbidding parallel fifths and octaves in Baroque counterpoint; moving from the tonic to the dominant in the second subject for sonata form

that carry a tacit agreement amongst the members of a language community. The physical world in which a linguistic event can of course be measured, though reducing a speech act to its most fundamental level would require all linguists to be physicists as well. For the music-language comparison to hold, what must be clarified is to what extent do we have conscious awareness of the things we do, and to what extent does our deliberate manipulation of something affect how it is acquired, developed, processed, and understood. For example, grammatical rules in syntax allow linguists to exploit well-formedness as a research device, but these rules are always subject to intentional misuse by native speakers who, as freethinking agents, are free to manipulate and break any given parameter. Not only that, no linguist could tell them that they are wrong for doing it without emanating the appearance of a prescriptivist. It is possibly for this reason that music is often compared to poetry. A musical event is characterised by the deliberateness with which it was created. Language, however, is effortless and changes organically over expanses of time. I believe that the understanding of *intentionality* in music and language is one of the primary differences in mentalities between the two fields. Musicians tend to unconditionally recognise it as semantically integral to music while linguists act as if it is not relevant for language.

The catalyst between music and language differences may be relative to the degree of concreteness by which each can be 'disambiguated' and the amount of deliberateness we are willing to attribute to the formation of a musical or linguistic 'utterance'. Meaning in music is certainly the most problematic area to draw direct connections with language. However, given the abundance of empirical similarities presented in this paper, perhaps it is for this reason that we encounter certain differences in neural organisation and processing at the structural and phonological level. Phoneticians should not discard the relevance of music because there is no equivalent to allophones, nor the syntactician in regard to the absence of prepositional phrases. The semantic nature of music does not necessitate them, thus they remain absent. Instead, linguists should recognise that music expresses itself in a similar, but different way from language, and exploit the awareness of these similarities and differences to explore linguistic principles in progressive ways. Knowing what something is not is just as useful as knowing what it is. Recognising music and language for what they are collectively would be a good step towards recognising what they are individually.

Fine

Appendix A

Experiment 1: Musical Score

Melody in D Major, corresponding to *kiki*. Written for and performed on a nylon string guitar; Tempo – *Andante*

Melody in d minor, corresponding to *bouba*. Written for and performed on nylon string guitar; Tempo – *Andante*

Appendix B

Experiment 2: The Questionnaire

Language and Music Questionnaire Form

Instructions

Linguist Version Only
First, please **circle** one of the following that identifies your academic standing in the field of linguistics.

1. Current or graduated university student of Linguistics

2. University teacher or researcher of Linguistics

Musician Version Only
First, please **circle** one of the following that identifies your academic standing in the field of music.

1. Current or graduated university student of Music

2. University teacher or researcher of Music

Please endeavour to answer this questionnaire as true to your own judgments and current linguistic/musical knowledge as possible. When finished, place the entire form inside of the provided self-addressed stamped envelope and post the letter anonymously (that is, seal the envelope and drop it in a mailbox).

My address again is:

David Houston
Mylne's Court ESH 5/08
Lawnmarket
Edinburgh, UK
EH1 2PF

Your efforts are most sincerely appreciated. Thank you, David

Part I

Linguist Version Only:

Of the following 10 options, choose 3 that you believe share the most relevance to music and 3 that you believe have little or no connection with music. Mark with 'X'.

Subject	Relevant	Least Relevant
Phonetics / Phonology		
Prosody		
Morphology		
Syntax		
Semantics		
Pragmatics		
Origins / Evolution of Language		
First Language Acquisition		
Second Language Acquisition		
Visual Word Recognition		

Musician Version Only:

Of the following 10 options, choose 3 that you believe share the most relevance to linguistics and 3 that you believe have little or no connection with linguistics. Mark with 'X'.

Subject	Relevant	Least Relevant
Music Theory		
Solfeggio / Sight Singing		
Solo Performance		
Acoustics		
Perfect Pitch		
Composition		
Sight Reading		
Music Therapy		
Music Appreciation		
Learning to play an instrument		

Terminology: Please indicate with 'X' for which of the following terms you would be able to provide an adequate working definition.

Terminology	Yes	No	Terminology	Yes	No
Universal Grammar			Metre		
Harmonic Analysis			Formant		
Phoneme			Relative Pitch		
Recursion			Ambient Language		
Atonality			Schenkarian Analysis		
Tone Language			Overtone		

Part II

(Please respond to the statements with your opinion based upon the following scale).

1 – strongly disagree
2 – disagree
3 – neutral
4 – agree
5 – strongly agree

1. Acquisition and Development	
Exposure to music accelerates the acquisition of a first language.	1
The music-like elements of speech are very appealing to pre-linguistic infants.	2
The utterances directed towards and heard by pre-linguistic babies should be considered both as musical input and linguistic input.	3
The initial state of musical knowledge prior to experience with music is the same as the initial state of linguistic knowledge prior to experience with language.	4
Assuming normal potential for cognitive functioning, newborn infants are universally endowed with the ability to effortlessly learn a language and the ability to appreciate music.	5
Acquiring a second language assists with the study of music.	6
Studying music assists with the acquisition of a second language.	7
The use of music in the classroom as a learning device is an effective means of teaching a foreign language.	8

2. Organisation and Meaning	
Music can be ambiguous in its meaning and interpretation.	9
Language has more of a communicative function than music.	10
Emotional expression is more central to the purpose of music than to the purpose of language.	11
Spoken language is both manipulative and referential while music is principally manipulative.	12
Both language and music have a hierarchical structure, being constituted by acoustic elements (words or tones) that are combined into phrases (sentences or melodies), which can be further combined to make language or musical events.	13
Like language, musical phrases can be embedded within other similar musical phrases, enabling the generation of an infinite range of expressions from a finite set of elements.	14

Part II (Continued)

1 – strongly disagree
2 – disagree
3 – neutral
4 – agree
5 – strongly agree

3. Processing	
Language and music overlap in important ways in the brain, and thus studying the nature of this overlap can help illuminate interesting features about the functional and neural architecture of both domains.	15
The way in which we process written words is very similar to the way we process standard music notation.	16
Music is processed predominantly in the right hemisphere of the brain while language is processed predominantly in the left hemisphere.	17
Given that children use categorical perception to learn the phonology of their mother tongue, this same ability could be used to develop accurate pitch discrimination/identification if the child received adequate musical exposure.	18

4. General and Hypothetical	
Music has selective advantages for human evolution.	19
The general population has a better conscious understanding of how language works than how music works.	20
The general population has a greater appreciation for the aesthetics of music than the aesthetics of language.	21
If humans were able to hear but not speak or produce any noise from their mouths, a highly developed musical language would emerge in addition to gestural systems of communication.	22
Consider the following example. (Middle C played loudly for one-second means 'dog'). If music contained reference to concrete entities like the example provided, it would possess all of the same features that are found in a language such as English.	23

Part III

(Please **circle** one multiple-choice selection).

1. The amount of time and mental energy necessary to master a second language is ________ the amount of time and mental energy necessary to master a musical instrument.
A. more than B. less than C. similar to D. No comment

2. Motivation is ______ important for learning a musical instrument than/as it is for learning a second language.
A. more B. less C. equally D. No comment

3. Rhythm is _____ crucial feature for understanding musical production than/as it is for language production.
A. more of a B. less of a C. equally a D. No comment

4. Empirical evidence is __________ important for making advances within the field of linguistics than/as within the field of music.
A. more B. less C. equally D. No comment

5. The rules that govern language usage are ______ flexible in their application than/as the rules that govern music.
A. more B. less C. equally D. No comment

6. The study of genius is _____ important research topic to the field of music than/as to the field of linguistics.
A. a more B. a less C. an equally D. No comment

7. The study of cognitive deficiencies is _______ important research topic to the field of music than/as to the field of linguistics.
A. a more B. a less C. an equally D. No comment

8. From an evolutionary standpoint, which statement do you most agree with:
A. Music is a derivative of Language
B. Language is a derivative of Music
C. Both evolved in parallel to each other as separate communication systems
D. There was a single precursor for both Language and Music that split into two systems
E. Other

Part IV

The Literature: Listed below are some books, pedagogies, and journal publications that cross-examine music with the fields of linguistics, psychology, neuroscience, evolutionary theory, and other language related topics. Please identify with an 'X' in the appropriate box as to what capacity you are familiar with them.

Literature / Pedagogy	Don't know it	Heard of it	Vaguely Familiar	Very familiar
A Generative Theory of Tonal Music – Fred Lerdahl and Ray Jackendoff				
The Cognitive Neuroscience of Music – edited by Isabelle Peretz and Robert Zatorre				
The Psychology of Music – edited by Diana Deutsch				
The Musical Mind: The Cognitive Psychology of Music – John Sloboda				
The Singing Neanderthals – Steven Mithen				
Emotion and Meaning in Music – Leonard Meyer				
The Language of Music – Deryck Cooke				
The Suzuki Method				
Suggestopedia (Georgi Lozanov)				
Nature Neuroscience (July 2003 issue)				

Part V

1. Please consider and respond to the following sentence in your own words (critically, supportively, or both).

'Music is like a language.'

2. Please briefly describe what role music plays in your life (i.e. Have you had formal musical instruction?; Do you play an instrument? How often do you listen to music?, etc.)

3. Additional comments or specific qualification of any previous material

Appendix C

Data Spreadsheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	**LingMus**	**StudTea**	**I.2.1**	**I.2.2**	**I.2.3**	**I.2.4**	**I.2.5**	**I.2.6**	**I.2.7**	**I.2.8**	**I.2.9**	**I.2.10**	**I.2.11**	**I.2.12**	**II.1.1**	**II.1.2**	**II.1.3**	**II.1.4**	**II.1.5**	**II.1.6**	**II.1.7**
2	Linguists	Student	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	No	No	No	4.00	3.00	4.00	2.00	3.00	5.00	1.00
3	Linguists	Student	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	4.00	5.00	3.00	4.00	3.00	2.00	3.00
4	Linguists	Student	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	3.00	4.00	3.00	4.00	4.00	1.00	3.00
5	Linguists	Student	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	No	Yes	3.00	5.00	2.00	4.00	3.00	2.00	2.00
6	Linguists	Student	No	No	Yes	No	Yes	Yes	No	Yes	Yes	No	No	Yes	2.00	5.00	2.00	2.00	2.00	4.00	4.00
7	Linguists	Student	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	3.00	4.00	4.00	2.00	5.00	2.00	4.00
8	Linguists	Student	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	3.00	4.00	3.00	3.00	2.00	3.00	3.00
9	Linguists	Student	Yes	No	Yes	Yes	No	Yes	No	Yes	No	No	No	No	4.00	4.00	3.00	3.00	4.00	4.00	4.00
10	Linguists	Student	Yes	No	Yes	No	No	Yes	Yes	Yes	No	No	No	No	4.00	4.00	5.00	3.00	4.00	3.00	3.00
11	Linguists	Student	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	4.00	4.00	3.00	2.00	3.00	2.00	4.00
12	Linguists	Student	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	3.00	4.00	2.00	2.00	3.00	2.00	2.00
13	Linguists	Student	Yes	No	Yes	Yes	No	Yes	Yes	No	No	No	No	No	3.00	5.00	2.00	4.00	4.00	4.00	4.00
14	Linguists	Student	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No	3.00	3.00	3.00	4.00	4.00	3.00	3.00
15	Linguists	Student	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	3.00	5.00	2.00	3.00	4.00	3.00	3.00
16	Linguists	Student	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	5.00	5.00	4.00	4.00	5.00	5.00	5.00
17	Linguists	Student	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	2.00	3.00	3.00	3.00	2.00	2.00	2.00
18	Linguists	Student	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	No	No	Yes	4.00	4.00	4.00	2.00	4.00	4.00	4.00
19	Linguists	Student	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	1.00	4.00	4.00	3.00	4.00	2.00	3.00
20	Linguists	Student	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	3.00	4.00	3.00	4.00	4.00	3.00	3.00
21	Linguists	Teacher	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	No	No	3.00	4.00	3.00	3.00	3.00	3.00	3.00
22	Linguists	Teacher	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	3.00	4.00	2.00	2.00	2.00	1.00	1.00
23	Linguists	Teacher	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	3.00	4.00	3.00	3.00	3.00	2.00	2.00
24	Linguists	Teacher	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	5.00	5.00	3.00	3.00	4.00	3.00	5.00
25	Linguists	Teacher	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	No	No	No	3.00	4.00	3.00	3.00	4.00	2.00	3.00
26	Linguists	Teacher	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	No	4.00	5.00	2.00	5.00	5.00	3.00	3.00
27	Linguists	Teacher	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	Yes	3.00	3.00	4.00	3.00	5.00	2.00	2.00
28	Linguists	Teacher	Yes	No	Yes	Yes	No	Yes	No	No	No	No	No	No	1.00	3.00	1.00	2.00	4.00	1.00	1.00
29	Linguists	Teacher	Yes	No	Yes	Yes	No	Yes	No	No	No	No	No	No	2.00	3.00	3.00	3.00	3.00	3.00	3.00
30	Linguists	Teacher	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	No	3.00	3.00	3.00	3.00	3.00	3.00	3.00
31	Linguists	Teacher	Yes	No	Yes	Yes	No	Yes	No	No	No	No	No	No	2.00	3.00	2.00	1.00	2.00	2.00	2.00
32	Linguists	Teacher	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No	3.00	4.00	3.00	4.00	4.00	3.00	4.00
33	Linguists	Teacher	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	No	No	No	2.00	4.00	3.00	3.00	4.00	2.00	2.00
34	Linguists	Teacher	Yes	No	Yes	Yes	No	Yes	No	No	Yes	Yes	No	No	3.00	3.00	1.00	2.00	3.00	3.00	3.00
35	Linguists	Teacher	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	2.00	3.00	2.00	2.00	3.00	2.00	2.00
36	Linguists	Teacher	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	4.00	4.00	3.00	3.00	4.00	3.00	3.00
37	Musicians	Student	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	4.00	5.00	3.00	2.00	2.00	5.00	5.00
38	Musicians	Student	No	Yes	No	No	No	No	Yes	No	Yes	No	No	Yes	5.00	5.00	4.00	5.00	5.00	5.00	5.00
39	Musicians	Student	No	Yes	No	No	Yes	No	Yes	No	Yes	No	No	Yes	4.00	4.00	4.00	3.00	2.00	3.00	3.00
40	Musicians	Student	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	4.00	5.00	5.00	4.00	5.00	3.00	4.00
41	Musicians	Student	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	5.00	5.00	5.00	5.00	5.00	5.00	5.00
42	Musicians	Student	No	No	No	No	No	No	No	Yes	Yes	Yes	No	Yes	3.00	3.00	3.00	3.00	3.00	3.00	3.00
43	Musicians	Student	No	Yes	No	No	Yes	No	Yes	No	Yes	No	No	Yes	4.00	4.00	4.00	5.00	2.00	4.00	4.00
44	Musicians	Student	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	3.00	3.00	4.00	2.00	2.00	3.00	3.00
45	Musicians	Teacher	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	3.00	4.00	3.00	3.00	4.00	3.00	4.00
46	Musicians	Teacher	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	3.00	4.00	5.00	3.00	5.00	3.00	3.00
47	Musicians	Teacher	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	5.00	5.00	5.00	5.00	5.00	3.00	4.00
48	Musicians	Teacher	No	No	No	No	No	No	No	No	No	No	No	No	5.00	5.00	3.00	3.00	5.00	5.00	5.00
49	Musicians	Teacher	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	4.00	4.00	4.00	2.00	2.00	4.00	4.00
50	Musicians	Teacher	No	Yes	No	No	Yes	No	No	No	Yes	No	No	Yes	5.00	5.00	5.00	5.00	5.00	4.00	4.00
51	Musicians	Teacher	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	3.00	4.00	4.00	4.00	4.00	3.00	3.00
52	Musicians	Teacher	No	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes	Yes	3.00	3.00	3.00	4.00	5.00	3.00	3.00
53	Musicians	Teacher	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	No	Yes	Yes	3.00	5.00	4.00	2.00	3.00	3.00	3.00

Section II
1 - Strongly Disagree
2 - Disagree
3 - Neutral
4 - Agree
5 - Strongly Agree

Section III
1 - More than
2 - Less than
3 - Equal to
4 - No Comment

Section IV
1 - Don't Know
2 - Heard of it
3 - Vaguely Familiar
4 - Very Familiar

	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP
1	**II.1.8**	**II.2.1**	**II.2.2**	**II.2.3**	**II.2.4**	**II.2.5**	**II.2.6**	**II.3.1**	**II.3.2**	**II.3.3**	**II.3.4**	**II.4.1**	**II.4.2**	**II.4.3**	**II.4.4**	**II.4.5**	**III.1**	**III.2**	**III.3**	**III.4**	**III.5**
2	3.00	5.00	1.00	4.00	4.00	5.00	5.00	4.00	2.00	3.00	3.00	4.00	4.00	5.00	2.00	2.00	3.00	3.00	1.00	1.00	1.00
3	2.00	5.00	4.00	5.00	4.00	2.00	3.00	4.00	3.00	2.00	4.00	4.00	4.00	5.00	4.00	1.00	4.00	1.00	1.00	1.00	4.00
4	4.00	4.00	5.00	4.00	3.00	4.00	4.00	3.00	3.00	3.00	4.00	3.00	4.00	3.00	3.00	2.00	1.00	4.00	4.00	1.00	4.00
5	4.00	5.00	5.00	2.00	3.00	5.00	5.00	4.00	3.00	3.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	1.00	3.00	1.00	3.00
6	3.00	5.00	5.00	2.00	4.00	4.00	3.00	4.00	4.00	2.00	2.00	3.00	2.00	3.00	3.00	1.00	4.00	1.00	1.00	1.00	2.00
7	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	2.00	4.00	4.00	5.00	4.00	5.00	1.00	2.00	3.00	3.00	1.00	3.00	2.00
8	3.00	5.00	4.00	4.00	4.00	3.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	2.00	3.00	3.00	1.00	4.00	1.00
9	3.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	3.00	4.00	4.00	4.00	3.00	4.00
10	4.00	4.00	4.00	2.00	2.00	4.00	4.00	3.00	2.00	3.00	3.00	3.00	4.00	1.00	4.00	3.00	3.00	3.00	1.00	4.00	3.00
11	5.00	5.00	5.00	4.00	3.00	4.00	4.00	2.00	2.00	3.00	2.00	2.00	4.00	3.00	2.00	3.00	1.00	1.00	1.00	1.00	4.00
12	5.00	5.00	5.00	4.00	4.00	4.00	4.00	3.00	2.00	2.00	3.00	3.00	4.00	4.00	1.00	2.00	1.00	3.00	1.00	1.00	2.00
13	4.00	5.00	4.00	4.00	5.00	5.00	4.00	2.00	4.00	4.00	3.00	4.00	2.00	5.00	3.00	1.00	3.00	3.00	3.00	1.00	1.00
14	3.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00	2.00	4.00	3.00	2.00	3.00	3.00	1.00	3.00	2.00
15	3.00	5.00	5.00	5.00	5.00	5.00	5.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	2.00	2.00	4.00	3.00	1.00	1.00	3.00
16	5.00	5.00	2.00	2.00	4.00	5.00	5.00	5.00	4.00	3.00	4.00	3.00	5.00	5.00	3.00	3.00	2.00	3.00	3.00	3.00	1.00
17	2.00	4.00	5.00	3.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	2.00	3.00	3.00	2.00	1.00	1.00	3.00	1.00	4.00
18	3.00	2.00	4.00	4.00	2.00	4.00	2.00	5.00	4.00	4.00	2.00	3.00	4.00	4.00	2.00	2.00	3.00	1.00	3.00	4.00	3.00
19	2.00	5.00	4.00	4.00	5.00	5.00	2.00	3.00	2.00	3.00	4.00	2.00	2.00	4.00	4.00	3.00	2.00	1.00	1.00	1.00	2.00
20	5.00	5.00	5.00	4.00	4.00	5.00	5.00	5.00	4.00	4.00	5.00	3.00	2.00	3.00	3.00	3.00	2.00	3.00	1.00	3.00	3.00
21	3.00	5.00	3.00	4.00	2.00	4.00	3.00	3.00	3.00	3.00	2.00	3.00	2.00	3.00	4.00	3.00	4.00	3.00	1.00	3.00	4.00
22	4.00	5.00	4.00	4.00	4.00	2.00	4.00	2.00	1.00	3.00	3.00	3.00	5.00	2.00	3.00	4.00	3.00	3.00	3.00	3.00	3.00
23	4.00	4.00	5.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	1.00	3.00	3.00	4.00	4.00
24	5.00	4.00	4.00	2.00	3.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	4.00	3.00	2.00	3.00	3.00	1.00	3.00	4.00
25	3.00	1.00	5.00	5.00	2.00	4.00	5.00	4.00	3.00	3.00	3.00	3.00	2.00	4.00	3.00	2.00	2.00	3.00	1.00	3.00	2.00
26	4.00	4.00	5.00	5.00	4.00	5.00	5.00	5.00	5.00	3.00	5.00	4.00	1.00	5.00	3.00	2.00	3.00	1.00	3.00	3.00	3.00
27	2.00	4.00	4.00	2.00	3.00	4.00	4.00	3.00	3.00	3.00	3.00	2.00	2.00	4.00	3.00	1.00	2.00	4.00	1.00	3.00	1.00
28	4.00	3.00	4.00	2.00	3.00	5.00	2.00	3.00	3.00	3.00	2.00	2.00	2.00	4.00	3.00	1.00	4.00	4.00	1.00	4.00	4.00
29	3.00	3.00	4.00	3.00	3.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	4.00	2.00	3.00	2.00	3.00	3.00	1.00	4.00	4.00
30	4.00	4.00	4.00	2.00	3.00	4.00	4.00	4.00	3.00	3.00	2.00	3.00	4.00	3.00	3.00	3.00	4.00	3.00	1.00	3.00	4.00
31	3.00	5.00	5.00	2.00	5.00	5.00	4.00	3.00	3.00	3.00	4.00	2.00	2.00	3.00	3.00	2.00	1.00	3.00	1.00	1.00	2.00
32	3.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00	4.00	3.00	4.00	3.00	2.00	4.00	2.00	2.00	3.00	3.00	1.00	1.00	3.00
33	2.00	3.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	4.00	3.00	2.00	2.00	4.00	3.00	2.00	3.00	3.00	1.00	1.00	4.00
34	3.00	3.00	5.00	3.00	3.00	3.00	4.00	3.00	3.00	4.00	2.00	3.00	2.00	3.00	1.00	1.00	4.00	4.00	4.00	4.00	4.00
35	1.00	4.00	4.00	3.00	2.00	3.00	2.00	3.00	3.00	3.00	3.00	4.00	1.00	3.00	1.00	1.00	4.00	1.00	1.00	3.00	4.00
36	2.00	4.00	4.00	4.00	2.00	2.00	2.00	3.00	2.00	3.00	3.00	4.00	4.00	4.00	3.00	2.00	4.00	3.00	1.00	1.00	2.00
37	5.00	5.00	2.00	4.00	2.00	4.00	5.00	5.00	4.00	3.00	4.00	4.00	5.00	4.00	3.00	1.00	2.00	3.00	1.00	4.00	2.00
38	5.00	4.00	4.00	2.00	2.00	4.00	5.00	5.00	5.00	2.00	4.00	4.00	5.00	5.00	5.00	4.00	3.00	3.00	3.00	3.00	3.00
39	3.00	4.00	2.00	2.00	2.00	3.00	4.00	4.00	4.00	3.00	3.00	3.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	1.00	2.00
40	5.00	3.00	2.00	2.00	3.00	4.00	5.00	5.00	5.00	2.00	5.00	5.00	4.00	4.00	5.00	5.00	3.00	3.00	3.00	3.00	3.00
41	5.00	5.00	1.00	1.00	1.00	5.00	5.00	5.00	5.00	3.00	5.00	5.00	4.00	1.00	4.00	5.00	2.00	3.00	3.00	3.00	2.00
42	3.00	5.00	3.00	4.00	3.00	4.00	4.00	5.00	3.00	4.00	3.00	3.00	5.00	2.00	3.00	3.00	4.00	3.00	1.00	3.00	2.00
43	5.00	3.00	1.00	4.00	3.00	5.00	4.00	5.00	5.00	3.00	5.00	5.00	5.00	4.00	4.00	2.00	3.00	3.00	1.00	3.00	3.00
44	3.00	5.00	5.00	3.00	2.00	4.00	4.00	3.00	2.00	3.00	4.00	2.00	4.00	4.00	2.00	1.00	2.00	2.00	1.00	1.00	2.00
45	3.00	5.00	5.00	2.00	3.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	2.00	4.00	3.00	4.00	3.00	3.00	1.00	1.00	4.00
46	3.00	5.00	2.00	2.00	2.00	3.00	4.00	4.00	1.00	3.00	4.00	3.00	2.00	3.00	3.00	2.00	3.00	3.00	3.00	3.00	2.00
47	4.00	3.00	1.00	1.00	1.00	3.00	4.00	3.00	3.00	3.00	3.00	4.00	2.00	3.00	3.00	1.00	2.00	3.00	3.00	3.00	2.00
48	4.00	5.00	5.00	1.00	2.00	2.00	2.00	4.00	2.00	3.00	3.00	4.00	2.00	2.00	2.00	5.00	3.00	3.00	3.00	3.00	3.00
49	4.00	5.00	3.00	4.00	3.00	5.00	5.00	4.00	3.00	2.00	3.00	3.00	5.00	2.00	4.00	2.00	3.00	1.00	3.00	4.00	2.00
50	3.00	4.00	4.00	3.00	3.00	5.00	5.00	5.00	5.00	2.00	4.00	4.00	4.00	3.00	4.00	3.00	3.00	3.00	1.00	4.00	2.00
51	4.00	5.00	4.00	3.00	3.00	4.00	5.00	4.00	3.00	4.00	3.00	2.00	5.00	2.00	4.00	3.00	2.00	3.00	1.00	3.00	3.00
52	1.00	5.00	4.00	4.00	2.00	5.00	5.00	3.00	2.00	3.00	4.00	3.00	4.00	4.00	3.00	4.00	3.00	3.00	1.00	4.00	3.00
53	4.00	4.00	4.00	4.00	4.00	3.00	3.00	5.00	3.00	3.00	4.00	4.00	2.00	3.00	3.00	2.00	4.00	3.00	3.00	3.00	4.00

Section II
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4 - Agree
5 - Strongly Agree

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Section IV
1 - Don't Know
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	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC
1	**III.6**	**III.7**	**III.8**	**IV.1**	**IV.2**	**IV.3**	**IV.4**	**IV.5**	**IV.6**	**IV.7**	**IV.8**	**IV.9**	**IV.10**
2	1.00	3.00	3.00	1.00	1.00	1.00	2.00	2.00	1.00	1.00	2.00	1.00	1.00
3	3.00	3.00	3.00	3.00	1.00	1.00	2.00	4.00	1.00	1.00	1.00	1.00	1.00
4	4.00	2.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	3.00	3.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	4.00	1.00	1.00
6	3.00	2.00	5.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00	3.00	1.00	1.00
7	1.00	3.00	4.00	2.00	1.00	1.00	1.00	4.00	1.00	1.00	2.00	1.00	1.00
8	3.00	3.00	5.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00
9	4.00	3.00	5.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00	1.00	1.00	1.00
10	1.00	2.00	4.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00
11	1.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	3.00	3.00	3.00	1.00	1.00	1.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00
13	1.00	2.00	4.00	1.00	1.00	2.00	1.00	1.00	2.00	2.00	1.00	1.00	2.00
14	3.00	3.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00
15	3.00	3.00	4.00	1.00	1.00	1.00	2.00	3.00	1.00	2.00	1.00	1.00	1.00
16	4.00	3.00	4.00	4.00	2.00	3.00	4.00	1.00	4.00	4.00	3.00	2.00	1.00
17	3.00	3.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00
18	1.00	2.00	5.00	3.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00
19	1.00	3.00	4.00	2.00	1.00	1.00	2.00	2.00	3.00	3.00	2.00	1.00	1.00
20	3.00	3.00	4.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00
21	1.00	2.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
22	1.00	3.00	3.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23	4.00	3.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24	4.00	4.00	5.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	4.00	1.00	1.00
25	1.00	3.00	5.00	2.00	1.00	1.00	1.00	1.00	2.00	1.00	3.00	1.00	1.00
26	3.00	3.00	4.00	1.00	1.00	1.00	1.00	4.00	1.00	1.00	2.00	1.00	1.00
27	1.00	2.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	2.00
28	3.00	3.00	5.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	4.00	3.00	1.00
29	1.00	2.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
30	3.00	3.00	5.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
31	1.00	2.00	1.00	2.00	1.00	1.00	1.00	4.00	1.00	1.00	1.00	1.00	2.00
32	1.00	2.00	5.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00
33	1.00	4.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00
34	4.00	4.00	4.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	4.00	1.00	3.00
35	3.00	3.00	5.00	3.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00
36	4.00	1.00	5.00	1.00	2.00	2.00	1.00	1.00	1.00	2.00	2.00	1.00	3.00
37	4.00	3.00	3.00	2.00	1.00	1.00	3.00	1.00	1.00	2.00	4.00	1.00	1.00
38	1.00	1.00	2.00	1.00	1.00	4.00	3.00	3.00	3.00	3.00	4.00	1.00	1.00
39	4.00	2.00	1.00	1.00	1.00	3.00	1.00	1.00	1.00	1.00	4.00	1.00	1.00
40	3.00	3.00	2.00	3.00	4.00	4.00	3.00	4.00	2.00	2.00	3.00	4.00	3.00
41	3.00	3.00	2.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	3.00	1.00	1.00
42	4.00	3.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	3.00	1.00	1.00
43	4.00	3.00	3.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	4.00	1.00	1.00
44	4.00	3.00	1.00	2.00	1.00	1.00	1.00	1.00	3.00	3.00	3.00	1.00	1.00
45	1.00	2.00	3.00	3.00	1.00	2.00	2.00	1.00	3.00	3.00	3.00	1.00	1.00
46	4.00	3.00	3.00	4.00	3.00	2.00	3.00	2.00	4.00	4.00	3.00	1.00	1.00
47	3.00	3.00	4.00	4.00	1.00	3.00	4.00	1.00	4.00	4.00	3.00	1.00	1.00
48	4.00	3.00	2.00	4.00	1.00	2.00	4.00	2.00	4.00	4.00	3.00	1.00	1.00
49	3.00	4.00	3.00	1.00	1.00	2.00	1.00	1.00	3.00	3.00	4.00	1.00	1.00
50	3.00	3.00	3.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00
51	1.00	3.00	3.00	4.00	2.00	3.00	3.00	1.00	4.00	3.00	3.00	1.00	1.00
52	4.00	3.00	3.00	3.00	1.00	2.00	2.00	1.00	3.00	3.00	3.00	1.00	1.00
53	4.00	3.00	4.00	4.00	3.00	4.00	4.00	1.00	4.00	4.00	2.00	1.00	1.00

Section II
1 - Strongly Disagree
2 - Disagree
3 - Neutral
4 - Agree
5 - Strongly Agree

Section III
1 - More than
2 - Less than
3 - Equal to
4 - No Comment

Section IV
1 - Don't Know
2 - Heard of it
3 - Vaguely Familiar
4 - Very Familiar

Appendix D

Part IA: Tally of Subject Areas

D.1 Most Relevant: Linguists

Subject	Students	Teachers	Total
Prosody	18	14	32
Phonology	12	10	22
Morphology	1	1	2
Syntax	9	11	20
Semantics	1	0	1
Pragmatics	2	1	3
Orig/Evol. of Lang	5	5	10
FLA	4	4	8
SLA	3	1	4
Visual Word Rec	1	1	2

D.2 Least Relevant: Linguists

Subject	Students	Teachers	Total
Prosody	0	0	0
Phonology	0	0	0
Morphology	8	7	15
Syntax	3	1	4
Semantics	9	10	19
Pragmatics	9	10	19
Orig/Evol. of Lang	1	0	1
FLA	9	6	15
SLA	7	6	13
Visual Word Rec	11	8	19

D.3 Most Relevant: Musicians

Subject	Students	Teachers	Total
Music Theory	4	4	8
Solfeggio	5	1	6
Solo Performance	0	1	1
Acoustics	1	0	1
Perfect Pitch	1	2	3
Composition	4	4	8
Sight Reading	3	3	6
Music Therapy	3	3	6
Music Appreciation	2	3	5
Playing an Instrument	1	3	4

D.4 Least Relevant: Musicians

Subject	Students	Teachers	Total
Music Theory	2	1	3
Solfeggio	1	2	3
Solo Performance	4	2	6
Acoustics	5	3	8
Perfect Pitch	4	6	10
Composition	1	1	2
Sight Reading	1	2	3
Music Therapy	2	3	5
Music Appreciation	2	1	3
Playing an Instrument	2	3	5

Appendix E

Part II: Chi-Square, Levene, and ANOVA Stats

Chi-Square Test 1: Linguists (all variables below p=.05)

Test Statistics

	Acq and Dev1	Acq and Dev2	Acq and Dev3	Acq and Dev4	Acq and Dev5
Chi-Square	21.714	29.714	23.714	20.857	20.286
df	4	4	4	4	4
Asymp. Sig.	.000	.000	.000	.000	.000

Test Statistics

	Acq and Dev6	Acq and Dev7	Acq and Dev8	Org and Mean1	Org and Mean2	Org and Mean3
Chi-Square	17.429	15.143	12.286	27.714	41.143	23.714
df	4	4	4	4	4	4
Asymp. Sig.	.002	.004	.015	.000	.000	.000

Test Statistics

	Org and Mean4	Org and Mean5	Org and Mean6	Process1	Process2	Process3	Process4
Chi-Square	17.714	33.429	25.429	29.143	30.857	62.571	22.000
df	4	4	4	4	4	4	4
Asymp. Sig.	.001	.000	.000	.000	.000	.000	.000

Test Statistics

	Gen and Hypo1	Gen and Hypo2	Gen and Hypo3	Gen and Hypo4	Gen and Hypo5
Chi-Square	30.857	23.429	19.429	42.286	25.429
df	4	4	4	4	4
Asymp. Sig.	.000	.000	.001	.000	.000

Chi-Square Test 1: Musicians (5 variables identified *)

Test Statistics

	Acq and Dev1	Acq and Dev2	Acq and Dev3	*4	Acq and Dev5
Chi-Square	13.667	14.222	12.556	4.778	10.333
df	4	4	4	4	4
Asymp. Sig.	.008	.007	.014	.311	.035

Test Statistics

	Acq and Dev6	Acq and Dev7	Acq and Dev8	Org and Mean1	*10	*11
Chi-Square	22.556	14.222	9.778	22.556	2.556	7.000
df	4	4	4	4	4	4
Asymp. Sig.	.000	.007	.044	.000	.635	.136

Test Statistics

	Org and Mean4	Org and Mean5	Org and Mean6	Process1	*16	Process3	Process4
Chi-Square	10.889	11.444	18.111	13.667	4.778	27.556	15.889
df	4	4	4	4	4	4	4
Asymp. Sig.	.028	.022	.001	.008	.311	.000	.003

Test Statistics

	Gen and Hypo1	Gen and Hypo2	Gen and Hypo3	Gen and Hypo4	*23
Chi-Square	9.222	12.556	9.222	13.667	.889
df	4	4	4	4	4
Asymp. Sig.	.049	.014	.048	.008	.926

Levene's Test Homogeneity of Variances: 5 Variables Identified

	Levene Statistic	df1	df2	Sig.
Acq and Dev1	.265	1	51	.609
Acq and Dev2	1.379	1	51	.246
Acq and Dev3	.022	1	51	.883
4*	4.781	1	51	.033
5*	11.216	1	51	.002
Acq and Dev6	.119	1	51	.731
Acq and Dev7	.102	1	51	.750
Acq and Dev8	.008	1	51	.928
Org and Mean1	.038	1	51	.846
10*	11.876	1	51	.001
Org and Mean3	.754	1	51	.389
Org and Mean4	.004	1	51	.950
Org and Mean5	.199	1	51	.658
Org and Mean6	.273	1	51	.604
Process1	.210	1	51	.649
16*	9.509	1	51	.003
Process3	.124	1	51	.726
Process4	.127	1	51	.723
Gen and Hypo1	2.234	1	51	.141
Gen and Hypo2	.004	1	51	.949
Gen and Hypo3	.620	1	51	.435
Gen and Hypo4	.348	1	51	.558
23*	8.071	1	51	.006

One Way Analysis of Variance: 10 Variables Identified *

		Sum of Squares	df	Mean Square	F	Sig.
1*	Between Groups	7.161	1	7.161	8.617	.005
	Within Groups	42.386	51	.831		
	Total	49.547	52			
Acq and Dev2	Between Groups	.928	1	.928	1.632	.207
	Within Groups	28.997	51	.569		
	Total	29.925	52			
3*	Between Groups	14.053	1	14.053	19.250	.000
	Within Groups	37.230	51	.730		
	Total	51.283	52			
6*	Between Groups	10.179	1	10.179	11.330	.001
	Within Groups	45.821	51	.898		
	Total	56.000	52			
7*	Between Groups	8.863	1	8.863	9.858	.003
	Within Groups	45.854	51	.899		
	Total	54.717	52			
Acq and Dev8	Between Groups	1.711	1	1.711	1.572	.216
	Within Groups	55.497	51	1.088		
	Total	57.208	52			
Org and Mean1	Between Groups	.886	1	.886	1.091	.301
	Within Groups	41.416	51	.812		
	Total	42.302	52			
12*	Between Groups	9.662	1	9.662	10.919	.002
	Within Groups	45.130	51	.885		
	Total	54.792	52			
Org and Mean5	Between Groups	.084	1	.084	.113	.738
	Within Groups	37.916	51	.743		
	Total	38.000	52			
14*	Between Groups	3.048	1	3.048	3.720	.054
	Within Groups	41.783	51	.819		
	Total	44.830	52			
15*	Between Groups	6.476	1	6.476	9.417	.003
	Within Groups	35.071	51	.688		
	Total	41.547	52			
Process3	Between Groups	.604	1	.604	2.010	.162
	Within Groups	15.321	51	.300		
	Total	15.925	52			
18*	Between Groups	2.897	1	2.897	4.373	.042
	Within Groups	33.783	51	.662		
	Total	36.679	52			
Gen and Hypo1	Between Groups	1.754	1	1.754	2.677	.108
	Within Groups	33.416	51	.655		
	Total	35.170	52			
20*	Between Groups	8.255	1	8.255	5.971	.018
	Within Groups	70.500	51	1.382		
	Total	78.755	52			
Gen and Hypo3	Between Groups	1.963	1	1.963	2.031	.160
	Within Groups	49.283	51	.966		
	Total	51.245	52			
22*	Between Groups	4.961	1	4.961	7.236	.010
	Within Groups	34.963	51	.686		
	Total	39.925	52			

Chi-Square Test 2: Linguistic Student (2 variables over p=.05)

Test Statistics

	Acq and Dev1	Acq and Dev2	Acq and Dev3	Acq and Dev4	Acq and Dev5
Chi-Square	13.368	19.158	11.263	12.842	12.316
df	4	4	4	4	4
Asymp. Sig.	.010	.001	.024	.012	.015

Test Statistics

	Acq and Dev6	Acq and Dev7	Acq and Dev8	Org and Mean1	Org and Mean2	Org and Mean3
Chi-Square	6.000	10.211	7.053	28.632	19.684	24.421
df	4	4	4	4	4	4
Asymp. Sig.	.199	.037	.133	.000	.001	.000

Test Statistics

	Org and Mean4	Org and Mean5	Org and Mean6	Process1	Process2	Process3	Process4
Chi-Square	14.947	20.737	16.000	10.211	12.842	21.789	13.368
df	4	4	4	4	4	4	4
Asymp. Sig.	.005	.000	.003	.037	.012	.000	.010

Test Statistics

	Gen and Hypo1	Gen and Hypo2	Gen and Hypo3	Gen and Hypo4	Gen and Hypo5
Chi-Square	18.105	18.105	10.211	14.947	14.421
df	4	4	4	4	4
Asymp. Sig.	.001	.001	.037	.005	.006

Chi-Square Test 2: Linguistic Teacher (4 variables over p=.05)

Test Statistics

	Acq and Dev1	Acq and Dev2	Acq and Dev3	Acq and Dev4	Acq and Dev5
Chi-Square	10.875	15.875	15.875	15.250	9.000
df	4	4	4	4	4
Asymp. Sig.	.028	.003	.003	.004	.061

Test Statistics

	Acq and Dev6	Acq and Dev7	Acq and Dev8	Org and Mean1	Org and Mean2	Org and Mean3
Chi-Square	16.500	9.000	6.500	12.125	23.375	5.875
df	4	4	4	4	4	4
Asymp. Sig.	.002	.061	.165	.016	.000	.209

Test Statistics

	Org and Mean4	Org and Mean5	Org and Mean6	Process1	Process2	Process3	Process4
Chi-Square	9.625	14.625	10.875	25.250	30.250	46.500	12.125
df	4	4	4	4	4	4	4
Asymp. Sig.	.047	.006	.028	.000	.000	.000	.016

Test Statistics

	Gen and Hypo1	Gen and Hypo2	Gen and Hypo3	Gen and Hypo4	Gen and Hypo5
Chi-Square	14.000	10.875	12.125	30.875	12.125
df	4	4	4	4	4
Asymp. Sig.	.007	.028	.016	.000	.016

Chi-Square Test 2: Music Student (17 variables over p=.05)

Test Statistics

	Acq and Dev1	Acq and Dev2	Acq and Dev3	Acq and Dev4	Acq and Dev5
Chi-Square	7.000	7.000	7.000	3.250	8.250
df	4	4	4	4	4
Asymp. Sig.	.136	.136	.136	.517	.083

Test Statistics

	Acq and Dev6	Acq and Dev7	Acq and Dev8	Org and Mean1	Org and Mean2	Org and Mean3
Chi-Square	8.250	5.750	13.250	7.000	2.000	4.500
df	4	4	4	4	4	4
Asymp. Sig.	.083	.219	.010	.136	.736	.343

Test Statistics

	Org and Mean4	Org and Mean5	Org and Mean6	Process1	Process2	Process3	Process4
Chi-Square	8.250	10.750	12.000	15.750	5.750	10.750	5.750
df	4	4	4	4	4	4	4
Asymp. Sig.	.083	.030	.017	.003	.219	.030	.219

Test Statistics

	Gen and Hypo1	Gen and Hypo2	Gen and Hypo3	Gen and Hypo4	Gen and Hypo5
Chi-Square	3.250	12.000	9.500	3.250	.750
df	4	4	4	4	4
Asymp. Sig.	.517	.017	.050	.517	.945

Chi-Square Test 2: Music Teacher (14 variables over p=.05)

Test Statistics

	Acq and Dev1	Acq and Dev2	Acq and Dev3	Acq and Dev4	Acq and Dev5
Chi-Square	13.000	8.000	7.000	3.000	7.000
df	4	4	4	4	4
Asymp. Sig.	.011	.092	.136	.558	.136

Test Statistics

	Acq and Dev6	Acq and Dev7	Acq and Dev8	Org and Mean1	Org and Mean2	Org and Mean3
Chi-Square	17.000	11.000	11.000	17.000	6.000	3.000
df	4	4	4	4	4	4
Asymp. Sig.	.002	.027	.027	.002	.199	.558

Test Statistics

	Org and Mean4	Org and Mean5	Org and Mean6	Process1	Process2	Process3	Process4
Chi-Square	4.000	4.000	7.000	8.000	8.000	17.000	16.000
df	4	4	4	4	4	4	4
Asymp. Sig.	.406	.406	.136	.092	.092	.002	.003

Test Statistics

	Gen and Hypo1	Gen and Hypo2	Gen and Hypo3	Gen and Hypo4	Gen and Hypo5
Chi-Square	11.000	9.000	7.000	13.000	3.000
df	4	4	4	4	4
Asymp. Sig.	.027	.061	.136	.011	.558

Appendix F

Part III: Chi-Square Stats

Chi-Square Test 3: Linguists (2 Variables Identified)

Test Statistics

	1*	More/Less/ Equal2	More/Less/ Equal3	More/Less/ Equal4	5*
Chi-Square	5.840	22.200	28.000	14.214	.857
df	2	2	2	2	2
Asymp. Sig.	.054	.000	.000	.001	.651

Test Statistics

	More/Less/ Equal6	More/Less/ Equal7
Chi-Square	14.214	18.813
df	2	2
Asymp. Sig.	.001	.000

Chi-Square Test 3: Musicians (1 Variable Identified)

Test Statistics

	More/Less/ Equal1	More/Less/ Equal2	More/Less/ Equal3	More/Less/ Equal4	More/Less/ Equal5
Chi-Square	10.000	25.000	8.588	10.857	9.500
df	2	2	2	2	2
Asymp. Sig.	.007	.000	.014	.004	.009

Test Statistics

	6*	More/Less/ Equal7
Chi-Square	4.750	16.625
df	2	2
Asymp. Sig.	.093	.000

Part III: 8. How did music and language evolve?

Linguists

Evolution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Music from Lang	3	8.6	8.6	8.6
	Lang from Music	1	2.9	2.9	11.4
	Parallel	11	31.4	31.4	42.9
	Common ancestry	9	25.7	25.7	68.6
	Other	11	31.4	31.4	100.0
	Total	35	100.0	100.0	

Musicians

Evolution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Music from Lang	3	16.7	16.7	16.7
	Lang from Music	4	22.2	22.2	38.9
	Parallel	8	44.4	44.4	83.3
	Common ancestry	2	11.1	11.1	94.4
	Other	1	5.6	5.6	100.0
	Total	18	100.0	100.0	

Appendix G

Part IV: Knowledge of Salient Literature

G.1 Linguists: $N = 35$

Literature/Pedagogy	Don't know	Heard of	Vaguely fam.	Very fam.
Gen. Theory Tonal Music	22	9	3	1
Cog. Neuroscience Music	32	3	0	0
Psychology of Music	32	1	0	0
The Musical Mind	29	4	1	1
Singing Neanderthals	22	6	3	4
Emotion & Meaning Music	31	2	1	1
The Language of Music	30	3	1	1
Suzuki Method	18	7	6	4
Suggestopedia	30	4	1	0
Nature Neuroscience	28	5	2	0

G.2 Musicians: $N = 18$

Literature/Pedagogy	Don't know	Heard of	Vaguely fam.	Very fam.
Gen. Theory Tonal Music	8	2	3	5
Cog. Neuroscience Music	14	1	2	1
Psychology of Music	5	7	3	3
The Musical Mind	8	2	5	3
Singing Neanderthals	13	3	1	1
Emotion & Meaning Music	6	2	5	5
The Language of Music	5	3	6	4
Suzuki Method	0	2	10	6
Suggestopedia	17	0	0	1
Nat. Neuroscience	17	0	1	0

Appendix H

Part V: Is music like a language?

H.1 Linguistic Students

- Sure. It's extended over time, it conveys content, it can be written down, it can be studied, recited and it functions mainly over the auditory channel.
- I see the point that music can be seen as a second language, but I do not believe music and language can be equated. Language has a much more communicative and referential purpose than music. On the other hand, emotion can be well expressed in both and with more beauty the closer one gets to music (poetry or a song).
- I think music is like language in that both are extremely diverse. There are 6000 languages in the world and perhaps that many, or more, types of music. I think music, in particular, is a very difficult thing to categorise and may not even be as easy to define as language. Aside from difficulties with definitions, music is a central aspect of culture, and, like language, is a reflection of a particular culture. For example, reggae, to me is a happy, upbeat type of music that reflects warm weather and cool oceans. Celtic music, on the other hand, reminds me of wind whistling through the trees of an Irish glade.

H.2 Linguistic Teachers

- Maybe in the sense that they both have re-usable sound unity and structure, but systems like that are quite common. If that statement is true in a more interesting sense, I remain to be convinced, but the lack of support doesn't seem to stop people saying things like this.
- Music isn't like language (though you might be able to find some parallels) because mastery of music (even voice) is radically different from mastery of language. I don't believe that music is part of every human's cognitive ability in the way language is.
- In some ways like language - e.g. linear presentation/perception of what could be analysed as hierarchically organised phrases - but very unlike language proper. There is no equivalent of linguistic meaning in music. To the extent that one can refer to communication through music, this is a very different notion to the kind of communication typically achieved through language use. Note that when composers attempt to introduce any kind of 'compositionality' into music, this is typically not perceived by the listener (as opposed to the historically informed musicologist) and also typically leads to perceptions of the result being 'less musical'. Harmony and counterpoint are fundamentals of music that have no clear analogues in language.

H.3 Music Student

- Music is like a language in many ways (it is culturally learned, generally a social activity, it can express emotion and 'refer' to other things, such as the sound of a horse's gallop, etc.), but in some ways it can be more powerful than language; only skilled orators and actors can excite the same emotional response as music in the listener's mind; language is more precise, but without music we'd be depressed all the time, with no outlet for expressing complex emotion safely.
- It is like a language that exists mostly on an aesthetic level, while spoken languages exist more on a pragmatic level. Although music does serve practical purposes (tone languages, Morse code, and if you're trapped in an underground cave like in Goonies) and language does serve aesthetic purposes (poetry,

anagrams, etc.). This is not to say that language is more "communicative" than music, it is simply more practical.

- Language is an expressive medium for the conscious mind. It is subject to experience and is informed by memory. Spoken language has subjective limits, many of which are dependent on the age, education, culture and functioning ability of a particular individual. One has only so many words in their vocabulary with which to understand and describe the world they live in. The same barriers affect music as a language. It is a concrete representation of one's abstract perception of their world. It defines emotional content through rhythm, pitch and form. Like spoken language it represents the conscious/subconscious through various systemic devices. Music draws upon experience and memory, just as spoken language, in that one derives their musical ideas and phrases from what they have encountered in their past. With only so many words in a given language one has only so many ways of expressing their self. In western music there are only 12 tones one can work with to express an idea. Music is like a language because it is an expressive medium for the conscious mind, governed by experience and culture, and subject to the individuals' ability to communicate.

H.4 Music Teachers

- Music is a language, but to the average listener it's a foreign language with perceptible emotions. A non musical person will not understand what is being said but will generally be able to feel along with the music (like watching the Spanish language channel when you don't know the language: you understand what's going on but you don't know what they are saying exactly. I am referring to instrumental music, not lyric content. A composition in either language or music shares many formal characteristics, particularly with form, a linear development of story, and the contrasting of tension and release.
- I agree. Jazz seems especially so.
- As with many similes or analogies, there are elements of people's concept of music that fit the concept of language, and elements that don't. By this statement, one is highlighting the similarities. I would assume that this means

implying that music is communicative, uses sounds, and has, to some extent, a grammar. However, I don't think that music is like a language in all respects. Musical "utterances" often cannot be expressed in words, and I'd say they "tell" us quite different things. I usually take this kind of statement to be metaphorical in the sense of George Lakoff and Mark Johnson's work. In other words, we might well be shaping our concept of music by means of the concept of language, whether there's a complete correspondence of elements or not.

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